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ABSTRACT

This document contains teacher's materials for an 8-unit course in greenhouse management for 11th and 12th graders. The units are as follows: Producing Annual Bedding Plants; Foliage Plants; General Greenhouse Management; Poinsettia Production; Vegetable Bedding Plant Production: Tomatoes, Peppers, and Eggplants; Production of Potted Chrysanthemums; Flowering Pot Plants; and Foliage-Type Hanging Baskets. Materials in each unit include an introduction, list of competencies, general and specific performance objectives, suggested interest approaches, a unit outline, recommendations for evaluation and testing, a list of required equipment and supplies, supplementary materials, and a resource section. Appendices follow the units for which they are appropriate and provide charts and other supplementary information. (CML)

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GREENHOUSE MANAGEMENT CURRICULUM

GUIDE FOR VOCATIONAL AGRICULTURE/AGRIBUSINESS

BULLETIN NO. 1824

PROJECT DIRECTOR

Dr. David C. Drueckhammer

Funded by
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Office of Vocational Education

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FOREWORD

This Curriculum Guide, Greenhouse Management for Vocational Agriculture/Agribusiness, was produced as a result of a project funded by the Louisiana State Department of Education to the University of Southwestern Louisiana. This Unit represents the concerted efforts of Vocational Agriculture teachers throughout the State of Louisiana.

The Instructional Unit was developed for the express purpose of aiding experienced as well as beginning vocational agriculture/agribusiness teachers. The hope is that having these teaching materials will allow teachers to improve their instructional program as well as to have increased time available to spend on other phases of the total vocational education program. Performance objectives, current instructional content, informational sources, and supplemental materials are provided in the Unit.

We believe this Unit will make a major contribution to the improvement of instruction in Vocational Agriculture/ Agribusiness in Louisiana.

Thomas G. Clausen

Thomas G. Clausen, Ph.D.
State Superintendent of Education

ACKNOWLEDGEMENTS

This publication represents the cooperative efforts of personnel in the Department of Agricultural Sciences, Technology and Education at the University of Southwestern Louisiana, and the Office of Vocational Education, Louisiana State Department of Education. Special recognition goes to Dr. David Drueckhammer who served as Project Director and to Dr. Dennis L. Wollard who served as subject matter specialist. Special commendation also goes to members of the writing team, who worked diligently to make this publication a reality, and to Dr. Florent Hardy, Jr. who edited the final draft.

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GREENHOUSE MANAGEMENT
Eleventh and Twelfth Grades
8 Weeks

Course Description

An instructional program that provides individuals in high school vocational agriculture/agribusiness the opportunity to obtain skills and knowledge in the production of horticultural crops in the greenhouse. It includes the techniques of production such as propagation; insect and disease control; growing media needed; and light, temperature, humidity, moisture, and nutrient requirements of the plants. Greenhouse horticultural crops included in this curriculum are annual bedding plants, foliage plants, flowering basket plants, poinsettias, vegetable bedding plants, potted chrysanthemums, flowering pot plants and foliage-type hanging baskets. Prerequisites are Vocational Agriculture/Agribusiness I and II. Enrollment is recommended for eleventh and twelfth grade students.

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RATIONALE

The production of vegetables and ornamental plants in greenhouse units has become a significant part of Louisiana agriculture. Greenhouse production of these products has the potential for increased production, adding significantly to the income and employment of people in Louisiana. Additionally, some greenhouse crops are grown in relatively small amounts in Louisiana but could be profitably produced in larger amounts. Presently, we depend upon out-of-state sources for much of this production.

In order to train high school vocational agriculture/ agribusiness students and adults in the technique of proper greenhouse production, management, and plant care, this curriculum guide was developed. These curriculum materials provide information that will allow a larger number of students enrolled in vocational agriculture/agribusiness classes the opportunity to conduct Supervised Occupational Experience Programs using greenhouse production and management.

DESIGN OF THE GUIDE

The Greenhouse Management Curriculum Guide for Vocational Agriculture/Agribusiness is composed of eight units. Each unit begins with a brief introduction, competencies, general and specific performance objectives, methodology, suggested interest approaches, and a unit outline.

Specific objectives are included for each topic. Each objective is separated from the other material with a line drawn above and below the objective. The content is organized to facilitate a logical presentation of information. Suggested student activities are provided for each objective to enable students to achieve the objective. Additional activities may be added by the teacher. The activities listed are to assist teachers in creativity.

Appendices for units are provided immediately following the unit. These may be used to make visual aids for classroom use. Following the appendices are unit tests and answer sheets. The tests may be duplicated for classroom use or may serve as a guide for the teacher in test development.

Each unit includes recommendations for evaluation and testing, a list of needed equipment and supplies, supplementary materials, and a resource section. Listed in the resource section are references available to the teacher to supplement the curriculum guide.

Pages are numbered for each unit, e.g., a page numbered III-4 would be the fourth page of Unit III.

CONTENT OUTLINE

GREENHOUSE MANAGEMENT

ELEVENTH AND TWELFTH GRADES

Unit	Title	Suggested Time Schedule
Unit I	Producing Annual Bedding Plants	3-6 days
Unit II	Foliage Plants	3-6 days
Unit III	Flowering Basket Plants	3-6 days
Unit IV	Poinsettia Production	3-5 days
Unit V	Vegetable Bedding Production	2-4 days
Unit VI	Production of Potted Chrysanthemums	2-5 days
Unit VII	Flowering Pot Plants	3-6 days
Unit VIII	Foliage-Type Hanging Baskets	3-6 days
		8 weeks

UNIT I
PRODUCING ANNUAL BEDDING PLANTS

INTRODUCTION

Bedding plants represent a large segment of the floriculture industry. As a crop, they are exceeded in value only by mums. Future trends indicate bedding plants will continue to increase in popularity as consumers become more concerned with beautifying their surroundings.

The purpose of this unit is to provide training in the basic techniques needed to raise bedding plants successfully.

COMPETENCIES

To produce annual bedding plants as a public relations program, class lesson, and additional source of income.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Define terms related to bedding plants.
2. Describe the proper conditions needed to produce bedding plants in pots and flats.
3. Describe the proper conditions needed in the development of seedlings.
4. List the steps in transplanting seedlings.
5. Care for bedding plants prior to sale.
6. Identify some common bedding plants.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given a list of terms, students will be able to identify or give meaning to the terms with at least 75% accuracy.
2. Given a list of conditions to produce bedding plants in pots and flats, students will be able to select those conditions which are correct with at least 75% accuracy.

3. Given a list of terms used in the development of seedlings, students will be able to match the terms to the proper definition with at least 75% accuracy.

4. Given a list of steps to follow in transplanting seedlings, students will be able to complete the list with at least 75% accuracy.

5. Given a list of the proper conditions to care for bedding plants prior to sale, students will be able to complete the list with at least 75% accuracy.

6. Given a list of common bedding plants, students will be able to identify them with at least 75% accuracy.

METHODOLOGY

A combination of methods can be used to teach this unit. The instructor may incorporate field trips to a neighborhood greenhouse or nursery, utilize resource persons, or utilize an independent study program to broaden the students' knowledge of producing annual bedding plants. Lecture and class discussion can be used to bring out problems and procedures.

SUGGESTED INTEREST APPROACHES

1. Plan field trip to a nursery.

2. Discuss with the class potential income of producing annuals.

UNIT OUTLINE

I. Terms

   A. Aeration

   B. Annual

   C. Bed

   D. Bedding plant

   E. Damping-off

   F. Dibble

G. Fertilizer

H. Germination

I. Greenhouse

J. Hardening

K. Media

L. Pathogen

M. Pesticide

N. Propagate

O. Soluble fertilizer

P. Transplant

Q. Seedling

R. Flat

II. Producing Bedding Plants in Pots and Flats

A. Medium

B. Seed spacing

C. Seed covering

D. Temperature

E. Watering

F. Aeration

G. Labeling

III. Proper Development of Seedlings

A. Watering

B. Controlling temperature and light

C. Disease

D. Pest

IV. Transplanting Seedlings

V. Care of Bedding Plants Prior to Sale

A. Watering

B. Growing medium

C. Temperature

D. Lighting

E. Fertilizing

VI. Identification of Common Bedding Plants

A. Begonia

B. Coleus

C. Geranium

D. Impatiens

E. Marigold

F. Pansy

G. Petunia

H. Phlox

I. Portulaca

J. Verbena

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given a list of terms, students will be able to identify or give meaning with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Terms and definitions

1. Aeration - movement of air (oxygen) through the media.

2. Annual - plant that completes its life cycle in one growing season.

3. Bed - the area where plants are placed for growing.

4. Bedding plant - usually annuals or plants handled as annuals which are grown to transplant size in the greenhouse and then sold.

5. Damping-off - a disease that affects seedlings. Several different fungi may cause the disease, and this infestation commonly girdles the plant at the soil line which may result in plant death.

6. Dibble - pointed implement used to make holes in the soil when planting or transplanting.

7. Fertilizer - substances that furnish nutrients which are necessary for good plant growth.

8. Germination - the first stage of growth in a seed.

9. Greenhouse - a heated structure covered with glass or other transparent material which allows light to enter for good plant growth.

10. Hardening or Hardening-off - the gradual exposure of plants to environmental conditions similar to those in which the plants will be grown after transplanting.

11. Media - materials which produce a soil or soil-less root environment in which plants may function and thrive.

12. Pathogen - any microorganism that causes disease, especially bacteria and/or fungi.

13. Pesticide - a material used for the control or eradication of pests.

14. Propagate - the reproduction of plants by seed, cuttings, or grafting.

15. Soluble fertilizer - a fertilizer that dissolves in water.

16. Transplant - move a plant from one growing area to another.

17. Seedling - a young plant produced from seed.

18. Flat - shallow box in which seedlings or cuttings are started.

LEARNING ACTIVITIES

1. Discuss terms and definitions with the class.

2. Prepare a list of terms and their definitions.

OBJECTIVE 2. Given a list of conditions to produce bedding plants in pots and flats, students will be able to select those conditions which are correct with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Media

1. A fine-textured media which allows good contact with the seed should be used. Any fertilizer which is used should be mixed evenly throughout the media, and thoroughly watered. The container is then filled to the top edge and the media lightly firmed to allow for watering. If firmed too much, the media will lose air space and water-holding capacity.

B. Seed Spacing

1. As a general rule, bedding plants are grown from seed.

2. The seed may be either broadcast or planted in rows, but in either instance each seed should be spaced so that it does not contact another seed. If planted in rows, the rows should be spaced 1/2 - 1 1/2 inches apart depending upon the container and vigor of seedling.

3. The seed may be directly seeded into the container in which it is to be sold. To insure a good stand, usually two to three seeds are planted in each container and thinned to the desired number of seedlings per pot before crowding occurs.

C. Seed Covering

1. The seed should be covered to a depth which will allow easy germination. If small seed are sown, a fine vermiculite or sphagnum moss may be screened and broadcast over the surface to cover the seed to a depth of no more than 1/16 inch or the seed may be left uncovered. If the small seeds are not

covered with a medium, thin newspaper or glass panes should be placed over the flat to conserve moisture. Immediately upon germination the covering is removed.

2. Large seeds may be planted to a depth which is 2 1/2 to 3 times the diameter of the seed.

D. Temperature

1. Temperature is perhaps the most important factor which regulates seed germination. Crops may be divided into cool-season and warm-season crops, depending on the time the seed germinates and the plant grows. Cool-season crops require a media temperature no higher than 77 degrees F. Warm-season crops require a temperature no lower than 50 degrees F or 60 degrees F. Seeds not germinating due to too high or too low temperature is known as thermodormancy.

2. Air temperature must be adjusted accordingly to satisfy the above temperatures and crop. Artificial bottom heat, such as electrical heating cables, may be employed to facilitate the germination of difficult to grow species. These heating cables may be adjustable or preset at 72 degrees F.

E. Watering

1. After the seed have been sown and covered, the container should be watered in a manner which will not disturb the seed. This may be done with a fine mist nozzle, sub-surface irrigation, or by covering the container with burlap and thoroughly soaking it. However, some growers will cover the entire container with plastic or newspaper to retain moisture until germination takes place.

F. Aeration

1. An adequate supply of oxygen in the root area must be available to the seedlings to prevent damping-off and to produce strong healthy plants.

G. Labeling

1. Each container should be labeled with the following information:

a. name and variety of seed

b. date seeded

c. special treatments used

2. Information should be readable without disturbing container.

LEARNING ACTIVITIES

1. Discuss with class steps to follow in producing bedding plants in pots and flats.

2. Given materials, students will prepare seed flats, sow seeds, and care for germinating bedding plants.

3. Set up an experiment to illustrate the effect of temperature on seed germination.

4. Invite a class of elementary students to visit your greenhouse. Have your students help them plant seeds of marigolds, etc. in small pots. Then help them care for these plants until flowering occurs...perhaps for Easter or Mother's Day.

OBJECTIVE 3. Given a list of terms used in the development of seedlings, students will be able to match the terms to the proper definition with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Watering

1. The moisture supply should be constant but not excessive. The seed bed should be watered only enough to prevent the top of the media from drying. After the seedlings have emerged from the soil, they should be watered well until a good root system has been developed. As the root system develops, less watering is required.

B. Controlling Temperature and Light

1. Following germination and transplanting, air temperature should be 50 degrees to 60 degrees F

at night with the day temperature about 10 degrees F higher for most warm-season crops. Higher and lower temperatures, within reason, are usually unharmful to the seedlings.

2. Adequate light should be provided for the seedlings to prevent the production of long, spindly plants. However, full sunlight may not be needed in the early stages of plant growth. If too much heat is associated with light, it may be necessary to shade the plants. The most important factor in controlling heat is to maintain the temperature as nearly constant as possible.

C. Disease

1. The most common disease affecting bedding plants is damping-off, which is caused by one of three pathogens. These pathogens usually promote seed decay, stem rot, or root rot and can affect the upper or lower portion of the plant.

2. Most diseases affecting seedlings are present either in the soil or on the seed at planting time. The best method of disease control is prevention, which in most cases can be accomplished by treating the seed and sterilizing the media. Many seed-borne diseases can be controlled by treating the seed with Captan, Semesan, Spergon or other fungicides. Commercial seed used from a packet is usually clean. If the seed needs to be treated, open the packet and place a small amount of the fungicide in the packet with the seed. Shake the contents until the seeds are coated with the chemical. Always read and follow the directions as written on the fungicide label. If it is impracticable to sterilize the soil, it should not be used.

3. The most typical symptom of damping-off is a sudden collapse of seedlings at the soil line. Careful pasteurization of the media helps to avoid this problem. Pasteurization is achieved by heating moist soil for 30 minutes at 180 degrees F. Higher temperatures and longer durations may sterilize the soil, however toxic substances are frequently produced.

D. Pests

1. Slugs and aphids are the two most common pests attacking bedding plants. Other pests that may attack the plants are the two-spotted mite and

the white fly. Chemicals are available that will control these insects.

LEARNING ACTIVITIES

1. Demonstrate to students the correct way to treat seeds for disease prevention.

2. Demonstrate to students the correct way to pasteurize media.

3. Grow a few plants in different improper conditions to show students the effects of the conditions.

OBJECTIVE 4. Given a list of steps to follow in transplanting seedlings, students will be able to complete the list with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Transplanting Seedlings

1. Soon after the seedlings have developed the first pair of true leaves, plants which were sown directly in flats should be transplanted into the containers in which they will be sold.

LEARNING ACTIVITIES

1. Discuss with class steps to follow in transplanting seedlings.

2. Prepare a list of Do's to follow in transplanting seedlings.

3. Prepare a list of Don'ts to follow in transplanting seedlings.

4. Transplant seedlings.

5. Plant flowering annuals in the school landscape.

OBJECTIVE 5. Given a list of the proper conditions to care for bedding plants prior to sale, students will be able to complete the list with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Watering

1. Overwatering can be a problem. Plants should be watered early in the day so the foliage is dry before dark. This reduces the chance of disease. Apply enough water to wet the entire soil mass. Partial wetting of the soil will restrict root growth.

B. Growing Media

1. The growing media should contain a larger volume of media than the propagating media. It should be well drained, easily managed, and have a high nutrient and water-holding capacity.

C. Temperature

1. Plants should be kept at an air temperature of approximately 60-70 degrees F during the day and approximately 10 degrees F cooler at night.

2. After the plants are transplanted, the temperature should be lowered 10 degrees F to prevent the plants from becoming leggy. Reduced watering may also help produce a more compact plant.

D. Light

1. Plants should be given sufficient sunlight each day to produce high quality compact plants.

E. Fertilizing

1. Plants should be fertilized on a regular basis to insure rapid growth. The most practical method of fertilization is to use a soluble fertilizer with an injection system. This allows for a small application of fertilizer each time the plants are watered.

LEARNING ACTIVITIES

1. Sell bedding plants produced in the school greenhouse.

2. Place a small number of plants under improper conditions to show students the effects of the conditions.

OBJECTIVE 6. Given a list of common bedding plants, the students will be able to identify the plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Identification of Common Bedding Plants Using Slides and/or Plant Specimens

LEARNING ACTIVITIES

1. Head a discussion on the selection of appropriate varieties of bedding plants to grow in your greenhouse and area.

2. Visit a producer of bedding plants to observe and discuss the plant varieties which are being grown.

UNIT I TEST

Fill in the Blank: Using the following terms associated with bedding plants, fill in the blanks below.

fertilizers	damping-off	bed
transplant	pesticides	pathogens
dibble	aeration	hardening
bedding plants	annual	

1. _____ is the gradual exposure of plants to environmental conditions similar to those in which they will be grown after transplanting.

2. Movement of air through the media is termed _____.

3. _____ are chemicals used to control pests.

4. Plants used as annuals which are grown to transplant size are _____ _____.

5. To _____ is to move a plant from one growing area to another.

6. Any agents that cause disease are termed _____.

7. _____ is a plant which completes its life cycle in one growing season.

8. The area where the cut flower plants or pot plants are placed for growing is a _____.

9. _____ _____ is a disease which affects seedlings.

10. A _____ is a pointed instrument used to make holes in the soil when planting or transplanting.

11. Substances that furnish elements that are necessary for good plant growth are _____.

True or False: T or F

_____12. The media used to grow bedding plants should be fine-textured.

_____13. A soil temperature of 80 degrees F is desirable for propagating cool-season bedding plants.

_____14. After the media for seeding bedding plants has been placed in a container it should be firmed as much as possible.

_____15. Small seeds may be covered with a newspaper or glass, rather than with media, to maintain moisture.

_____16. After seeds have been sown and covered the container should be constantly flooded with water.

Matching: Column A with B

A		B	
_____17.	50 to 60 degrees F	a.	Proper daytime air temp. for bedding plants following germination and transplanting
_____18.	60 to 70 degrees F		
_____19.	Adequate light	b.	Typical symptom of damping-off
_____20.	Sudden collapse of seedlings	c.	Pasteurization
_____21.	180 degrees F for 30 minutes	d.	Proper night air temp. for bedding plants following germination and transplanting.
_____22.	Pests of bedding plants	e.	Prevents long spindly plants
		f.	Slugs and aphids

Fill in the Blank:

23. Plants which were sown directly into flats should be transplanted soon after the devvelopment of the first pair of _____ _____.

24. Plants should be transplanted into the containers in which they will be _____.

25. Bedding plants should be watered early in the day so the foliage is dry before _____.

26. Partial wetting of the soil will _____ root growth.

27. Bedding plants should be given _____ sunlight each day to produce high quality plants.

28. The most practical method of fertilizing bedding plants is to use _____ fertilizer with an injection system.

Identification:

Identify the following annual plants.

(Teacher preference of bedding plants)

UNIT I TEST
ANSWER KEY

Fill in the Blank

1. hardening
2. aeration
3. pesticides
4. bedding plants
5. transplant
6. pathogens
7. annual
8. bed
9. damping-off
10. dibble
11. fertilizers

True or False (T or F)

12. T
13. F
14. F
15. T
16. F

Matching

17. d
18. a
19. e
20. b
21. c
22. f

Fill in the Blank

23. true leaves

24. sold

25. dark

26. restrict

27. sufficient

28. soluble

Identification

(Number and plants of choice)

UNIT I
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Class participation
Students' demonstrating skills on campus or at an individual's home
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference Material
Notebook

Teacher

Reference Material
Pamphlets
Overhead Projector
Transparencies
Common Bedding Plants
Materials for Mix
Flats
Pots
Seeds of Common Bedding Plants

UNIT I
SUPPLEMENTARY MATERIALS

Bedding Plant Equipment, 36 color slides and script, order number 2092S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

Bedding Plant Production, task sheets, order number 2208L.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

Bedding Plants, 49 slides and script, order number 2090S.

Available From: Ohio Agricultural Education Curriculum Materials Service, room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

Flower and Plant Production in the Greenhouse, Kennard S. Nelson, Ph.D., The Interstate Printers and Publishers, Inc., 1967.

State FFA Floriculture Contest, 50 color slides and script, order number 5345.

Available From: Vocational Instructional Services, P. O. Box 182, College Station, Texas 77843

The Flower Identification Slide Set Series, 100 color slides and 4 student workbooks, order number 1-273-200G.

Available From: Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407

Tips on Growing Bedding Plants, 36 page bulletin, order number 226X.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

UNIT II
FOLIAGE PLANTS

INTRODUCTION

Foliage plants are grown for their attractive leaves and the pleasing affect these plants have on the work and home environment. Most of these foliage plants are classified as exotics and are native to tropical climates, which have high humidity and rainfall. Additional characteristics of tropical climates include soils high in organic matter and a minimum temperature of 70 degrees F. In addition to these climatic factors most grow in the shade of other, taller plants. In order for a grower to successfully grow foliage plants, these environmental conditions must be reproduced in the greenhouse.

The purpose of this unit is to provide training for students in the basic techniques and requirements needed to produce foliage plants.

COMPETENCIES

To successfully produce foliage plants in a greenhouse.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Identify the lighting requirements needed for foliage plants.
2. Identify the proper temperatures needed for foliage plants.
3. Identify the moisture and humidity requirements for foliage plants.
4. Identify the nutrients needed for foliage plants.
5. Identify the most suitable growing media for foliage plants.
6. Identify pests which are common to foliage plants.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given several light ranges, students will be able to select the proper range for foliage plants with at least 75% accuracy.

2. Given different temperature ranges, students will be able to select the proper range for foliage plants with at least 75% accuracy.

3. Given several moisture conditions, students will be able to select the proper one for foliage plant production with at least 75% accuracy.

4. Given different humidity ranges, students will be able to select the one most suitable for foliage plants with at least 75% accuracy.

5. Given a list of nutrients, students will be able to select the proper ones and the correct amount for foliage plants with at least 75% accuracy.

6. Given a list of insects, students will be able to identify the ones which are common pests of foliage plants with at least 75% accuracy.

7. Given a chart which includes temperature, humidity, light, water and fertilizer requirements for some common foliage plants, students will be able to select the proper conditions needed for a specific plant with at least 75% accuracy.

METHODOLOGY

Several methods can be used to teach this unit on foliage plants. The instructor can assign each student a plant and have them grow and care for the plant. Class lectures and discussions can be used to help each student with their problems and procedures. Also the instructor can incorporate a field trip to a greenhouse where foliage plants are being grown. A field trip to an office building where foliage plants are being used to enhance the appearance of the work area would also be helpful.

SUGGESTED INTEREST APPROACHES

1. Assign each student a plant which he/she is responsible for growing.

2. Plan field trip to a commercial greenhouse where foliage plants are being grown.

3. Plan field trip to a place of business where foliage plants are being used to enhance the appearance of the work area.

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given several light ranges, students will be able to select the proper range for foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Lighting Requirements

1. Proper light intensity for most foliage plants range from 25 to 1000 foot-candles.

2. It is necessary to meet the requirements of the particular foliage plant which is being grown.

3. Such plants as pothos, episcias and begonias respond well to artificial lights.

LEARNING ACTIVITIES

1. Prepare a chart showing the different light intensities required for several foliage plants.

2. Bring a typical artificial light table where plants are grown into the classroom.

OBJECTIVE 2. Given different temperature ranges, students will be able to select the proper range for foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Proper temperature range for normal growth

1. Daytime temperatures between 65 degrees F and 75 degrees F

2. Nighttime temperatures no lower than 55 degrees F

B. Effects of temperatures below 55 degrees F may result in

1. wilting

2. yellowing of leaves

3. leaves falling off

LEARNING ACTIVITIES

1. Stress the importance of maintaining a suitable temperature in the greenhouses.

2. Demonstrate the effects of too high and/or too low temperatures on foliage plants.

OBJECTIVE 3. Given several moisture conditions, students will be able to select the proper one for foliage plant production with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Judgement of proper watering is best determined by experience which includes touching and looking at the soil.

B. Watering must be consistent.

1. Long intervals between watering causes poorly formed root systems and wilting of the plant.

2. Soil which is too wet does not allow for oxygen in the soil.

C. Importance of choosing the proper water source.

1. Use of naturally soft water is best because it is salt free. Extra salts can build up in a pot or mix and damage the plant as a result of poor quality water.

2. Use of dechlorinated water is important because chlorine may affect plant growth adversely.

LEARNING ACTIVITIES

1. Students must be made aware of the fact that unless foliage plants are watered correctly, they will not grow to their full potential.

2. The teacher can set up a comparison demonstration with plants that are being watered properly and others which are not.

OBJECTIVE 4. Given different humidity ranges, students will be able to select the one most suitable for foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Foliage plants will tolerate an environment with a relative humidity of 50% and prefer a higher relative humidity.

B. Additional atmospheric and soil moisture is needed in the environment when greenhouses are heated.

C. Relative humidity may be increased in the greenhouse by lightly wetting the foliage and/or watering the dry benches and walkways.

D. Repeated problems with low relative humidity may be alleviated by utilizing an automatic mist system located below the benches and set on a timer.

LEARNING ACTIVITIES

1. Demonstrate different techniques needed to provide an adequate humidity for foliage plants.

OBJECTIVE 5. Given a list of nutrients, students will be able to select the proper ones and the correct amount for foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Fertilizer can be applied three ways.

1. Fertilizer may be applied in a granular form and the amount of fertilizer determined by the fertilizer label and/or a "soil" test from the LSU Cooperative Extension Service.

2. Use of a water soluble fertilizer is the easiest way to apply fertilizer. The rate of fertilizer is determined by the fertilizer concentration and development of plant growth. No matter how the fertilizer is applied, lime may be required to produce a suitable pH growing environment. This pH environment may also be determined by a "soil" test.

3. Slow release fertilizers such as "osmocote" or "magamp" may be utilized for long-term crops such as foliage. These fertilizers are available in various formulations, which may last approximately two to three months.

B. Excess fertilizers which are unused by the plant may build up in the soil. These unused fertilizers may be removed by leaching with fresh water.

LEARNING ACTIVITIES

1. Have students mix fertilizer into growing media which is to be used in the greenhouses.

2. Let students assist in the leaching process.

OBJECTIVE 6. Given a list of insects, students will be able to identify the ones which are common pests of foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Some pests which affect foliage plants are as follows: mealy bugs, scales, aphids and spider mites.

B. A common practice to control pests is to apply a pesticide, such as malathion and diazinon, at regular intervals. This is done for preventive measures.

C. Another common practice in controlling insects is to apply the insecticide only when the insects appear.

LEARNING ACTIVITIES

1. Collect several insects which are common pests and display them for the students.

OBJECTIVE 7. Given a chart which includes temperature, humidity, light, water and fertilizer requirements of some common foliage plants, students will be able to select the proper conditions to successfully grow foliage plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Instruction on how to find needed information on a certain foliage plant.

LEARNING ACTIVITIES

1. Have students grow one certain foliage plant, and have them grow the plant according to the attached chart (Appendix A).

APPENDIX A

	TEMPERATURE			HUMIDITY			LIGHT REQUIREMENTS				WATER			FERTILIZER			
COMMON NAME	Warm	Average	Cool	High	Medium	Low	Full Sun	Bright Indirect Light	Diffused Light	Shade	Heavy	Medium	Light	6 Mo.	4 Mo.	2 Mo.	1 Mo.[B]
Aglaonema	X	X			X	X			X	X	X	X		X	X		
Aralia	X	X		X	X		X	X				X		X	X		
Asparagus Fern		X	X		X			X				X			X		
Baby Tears	X	X		X				X	X		X					X	
Begonias	X	X		X	X			X				X				X	X
Bromeliads	X	X		X	X		X	X					X[C]	X			
Browallia			X	X	X		X					X					X
Caladium			X	X	X			X			X	X		Once a month only during active growth.[B]			
Croton	X	X			X		X	X				X	X		X	X	
Dieffenbachia	X	X			X	X		X	X	X		X	X	X	X		
Dracaena	X	X			X	X		X	X	X		X	X	X			
Episcia	X	X		X	X			X				X				X	X
Ferns		X	X[A]	X				X	X		X	X		X	X		
Ficus	X	X			X			X	X			X	X		X		
Fittonia	X	X		X				X	X		X	X				X	X
Grape Ivy	X	X			X			X	X	X		X			X	X	

COMMON NAME	TEMPERATURE			HUMIDITY			LIGHT REQUIREMENTS				WATER			FERTILIZER			
	Warm	Average	Cool	High	Medium	Low	Full Sun	Bright Indirect Light	Diffused Light	Shade	Heavy	Medium	Light	6 Mo.	4 Mo.	2 Mo.	1 Mo.[B]
Hoya	X	X			X	X		X					X		X		
Ivy		X	X		X	X	X	X	X			X	X		X		
Jade Plant			X[A]		X	X	X	X					X	X	X		
Nephthytis	X	X			X			X	X			X			X	X	
Parlor Palm	X	X			X			X	X	X		X	X	X	X		
Pellionia	X	X		X	X				X		X	X				X	
Peperomia	X	X			X			X	X			X	X		X		
Philodendron	X	X			X			X	X	X		X			X	X	
Pilea	X	X			X			X	X		X	X				X	
Pothos	X	X			X			X	X				X		X		
Prayer Plant	X	X			X			X	X			X				X	
Sansevieria	X	X			X	X	X	X	X	X		X	X		X		
Schefflera	X	X			X		X	X				X	X		X	X	
Spider Plant		X			X			X	X			X			X	X	
Swedish Ivy		X			X			X	X			X				X	X
Velvet Plant	X	X			X		X					X				X	X
Vinca Vine	X	X			X		X	X				X	X			X	
Waffle Plant	X	X		X	X			X	X	X	X	X				X	
Wandering Jew		X			X							X				X	
Zebra Plant	X	X		X					X		X	X				X	

A. Does not thrive at higher temperatures

B. Omit in mid-winter

C. Bromelaid-Cup must be kept full of water at all times; medium should be dry

UNIT II TEST

Multiple Choice -- Circle correct answer

1. The proper light intensity for most foliage plants is from ____.

   a. 4000 to 6000

   b. 1 to 25

   c. 25 to 1000 foot-candles

2. Plants that respond well to artificial lights include ____.

   a. african violets

   b. geraniums

   c. crotons

3. The proper daytime temperature range for normal growth of foliage plants is ____.

   a. 85 to 95 degrees F

   b. 65 to 75 degrees F

   c. 70 to 80 degrees F

4. Nighttime temperatures should drop no lower than ____.

   a. 65 degrees F

   b. 50 degrees F

   c. 55 degrees F

5. Temperatures below 55 degrees F may result in ____.

   a. wilting

   b. yellowing of leaves

   c. both a and b

6. Use of ____ water is best because it is salt free.

   a. naturally soft

   b. hard

   c. conditioned soft

7. Long intervals between watering causes ____.

   a. stunted growth of the plant

   b. leaves to turn brown

   c. poorly formed root systems

8. Soils that are too wet do not allow proper amounts of ____ into the soil.

   a. nitrogen

   b. oxygen

   c. carbon dioxide

9. Foliage plant production requires a relative humidity ____.

   a. below 50%

   b. above 80%

   c. between 30% and 50%

10. ____ moisture is needed in the environment when greenhouses are heated.

   a. less

   b. more

   c. about the same level of

11. Some pests which affect foliage plants are ____.

   a. mealy bugs

   b. earthworms

   c. roaches

12. A common practice to control pests is to apply, at regular intervals, a pesticide such as ____.

    a. roundup

    b. benlate

    c. malathion

13. Fertilizers may be applied in the form of ____.

    a. granular

    b. water soluble

    c. slow release

    d. all the above

14. Insects may be controlled by spraying ____.

    a. daily

    b. as pests appear

    c. at regular intervals for preventive measures

    d. both b and c

UNIT II
ANSWER KEY

1. c
2. a
3. b
4. c
5. c
6. a
7. c
8. b
9. b
10. b
11. a
12. c
13. d
14. d

UNIT II
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Class participation
The student's ability to demonstrate his/her ability to grow foliage plants successfully
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebooks

Teacher

Reference material
Pamphlets
Overhead projector
Transparencies
Potting buckets
Potting media
Access to greenhouses

UNIT II
SUPPLEMENTARY MATERIALS

Foliage Plants, 172 color slides with script, order number 2009S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Road, Columbus, Ohio 43210-1099

Plants for High School Greenhouses, 40 color slides, order number 5315.

Available From: Vocational Instructional Services, P. O. Box 182, College Station, Texas 78843

Teachers Handbook for Propagating Horticultural Plants, order number 107.

Available From: Vocational Instructional Services, P. O. Box 182, College Station, Texas 78843

UNIT III
GENERAL GREENHOUSE MANAGEMENT

INTRODUCTION

The production of flowering plants in the greenhouse can be a challenging and fascinating occupation or hobby. It is becoming increasingly more advanced as new technology is being developed and new plant varieties become available. A constant need for better informed workers and managers in the production of greenhouse plants is a necessity in order to maximize profits and turn out quality products.

The purpose of this unit is to provide necessary training and knowledge needed to grow flowering hanging baskets in the greenhouse.

COMPETENCIES

To grow flowering hanging baskets in the greenhouse as an additional source of income.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Select proper light requirements for plants used in hanging baskets in the greenhouse.
2. Select proper temperature requirements for plants used in hanging baskets in the greenhouse.
3. Identify moisture requirements for plants used in hanging baskets in the greenhouse.
4. Select proper humidity requirements for plants used in hanging baskets in the greenhouse.
5. Select proper nutrient requirements for plants used in hanging baskets in the greenhouse.
6. Identify pests of plants used in hanging baskets in the greenhouse.
7. Identify type of media used in transplanting plants used in hanging baskets in the greenhouse.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given light requirement situations for plants used in hanging baskets, students will be able to select proper lighting procedures with at least 75% accuracy.

2. Given temperature requirement situations for plants used in hanging baskets, students will be able to select proper temperature procedures and plant characteristics with at least 75% accuracy.

3. Given a written exam, students will be able to answer questions dealing with moisture requirements for plants used in hanging baskets with at least 75% accuracy.

4. Given humidity requirement situations for plants used in hanging baskets, students will be able to select proper humidity procedures with at least 75% accuracy.

5. Given nutrient requirement situations for plants used in hanging baskets, students will be able to select proper nutrient and fertilizer procedures with at least 75% accuracy.

6. Given a written exam dealing with pests of plants used in hanging baskets, students will be able to provide answers with at least 75% accuracy.

7. Given a written exam dealing with proper media requirements for plants used in hanging baskets, students will be able to provide answers with at least 75% accuracy.

METHODOLOGY

A combination of methods may be used to teach this unit. The instructor may utilize field trips to local nurseries, school greenhouses, resource persons, and hands-on lab work. Lecture and class discussions may be used to bring out procedures and possible problems with an effective way to solve these problems.

SUGGESTED INTEREST APPROACHES

1. Plan field trip to a local nursery growing hanging baskets.

2. Plan field trip to retail store selling hanging baskets.

3. Have students prepare growing media for hanging baskets in the school greenhouse as a class project.

4. Discuss with class the potential income of producing hanging baskets.

UNIT OUTLINE

I. Light Requirements

   A. Photosynthesis

   B. Photoperiod

II. Temperature Requirements

III. Moisture Requirements

   A. Overwatered

   B. Underwatered

IV. Humidity Requirements

   A. High pressure mist systems

V. Nutrient Requirements

   A. Organic matter

   B. Buffering effect

   C. Primary nutrients

VI. Pests in Greenhouse

   A. Spider mites

   B. Aphids

   C. Use of pesticides

VII. Proper Growing Media

   A. Drainage and aeration

   B. Fertility requirements

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given light requirement situations for plants used in hanging baskets, students will be able to select proper lighting procedures with at least 75% accuracy.

SUBJECT MATTER CONTENT

Photosynthesis - The ability of green plants to use the sun's energy along with water and minerals to manufacture food.

Chlorophyll - Green pigment needed in order for photosynthesis to occur.

Photosynthesis can take place most effectively in many greenhouse plants when the light intensity is about 6,000 foot-candles. Since light intensity on summer days may be more than 10,000 foot-candles, plants may grow better if grown in partial shade. There are several ways of shading plants which are as follows: (1) by spraying a shading compound on the outside of the glass (2) by placing a shade cloth above the plants in the greenhouse or (3) a combination of both 1 and 2.

Plants grown in too strong sunlight typically have short, heavy stems; small, light-colored leaves; and bleached flower color. With the right amount of shade during the summer, the stems will be longer, the leaves larger, and the color of leaves and flowers brighter.

In winter months, the light may not be above 500 foot-candles for several days at a time, and the day length is shorter than in summer. Food production in plants is seriously reduced under these conditions which affects the quality and quantity of flowers produced. There are several things that one may do to maximize the amount of light plants receive: (1) place plants farther apart, (2) remove overhead obstacles, (3) clean glass on greenhouse, (4) use artificial light (although not economical commercially).

Some plants respond to the length of day (photoperiod). This effect can be very important as it may cause flowering, leaf drop, tuber formation, or foliage colors. Its effect on flowering is of the most interest for greenhouse plants. Year-round flowering is made possible by controlling the length of continuous darkness. The cultivars of plants grown in baskets are relatively unaffected by the light duration.

MATERIALS LIST

1. Two pieces of glass or plastic
2. White paint (spray)
3. Gauze or cheese cloth

LEARNING ACTIVITIES

1. Discuss light requirements for plants used in hanging baskets.
2. Spray paint one piece of glass and compare how much light penetrates the painted glass to the clear glass. A similar comparison can be made by using various layers of gauze.

OBJECTIVE 2. Given temperature requirement situations for plants used in hanging baskets, students will be able to select proper temperature ranges and plant characteristics with at least 75% accuracy.

Temperature effects on plants are great. Particular attention is paid to night temperatures in the greenhouse. In fact, plants are usually classed by night temperatures. Day temperatures are usually 5 degrees to 10 degrees F warmer depending on whether the sky is sunny or cloudy. Generally speaking, plant growth is usually faster at warmer temperatures. However, such growth may be of poor quality. Flowers may be smaller and have a bleached color. The common night temperature in the greenhouse is 50 degrees F for such crops as snapdragons. Warmer temperatures are used for foliage plants or for plant propagation. Cooler temperatures are used for holding plants and for developing and maturing flower buds on some plants.

The influence of temperatures on diseases in the greenhouse directly affects the growth of disease organisms. Good air circulation and avoiding sudden temperature changes can reduce many disease problems. Temperature differences cause air circulation. Heated air is lighter and therefore rises. To get good air circulation in the greenhouse let the heaters heat air while having the ventilators partly open. This is usually done in winter. This may seem as a wasteful way to heat the greenhouse, but it performs the task by reducing humidity, evening the temperature in the greenhouse and getting fresh air.

LEARNING ACTIVITIES

1. Discuss effects low and high temperatures have on plants.

2. Discuss ways of heating and cooling your greenhouse.

OBJECTIVE 3. Given a written exam, students will be able to answer questions dealing with moisture requirements for plants used in hanging baskets with at least 75% accuracy.

SUBJECT MATTER CONTENT

Adding soil moisture is usually accomplished by a sprinkler or mist system in the greenhouse. Hand watering is yet another method. The greenhouse air is usually too dry during the day in the summer months and is even drier during the peak heating season because of the heated air. This causes rapid evaporation of media moisture and therefore must be replaced from time to time.

In dry air the water loss from the plants (transpiration) may be greater than water absorption, and wilting occurs. Cell enlargement will be reduced, plants will be shorter, the flowers and leaves smaller, and the rate of growth slower. Water enters the plant primarily through the roots in the root hair zone. A good grower constantly inspects the root system of his/her plants and must provide conditions that encourage good plant growth. Water is one of the basic ingredients that the plant uses in the absorption of nutrients and in the food manufacturing process of photosynthesis. A continual, adequate supply of water is needed for both respiration and transpiration in the plant. An adequate supply of water in the soil is needed; however, only enough water should be provided to assume the best growth. Root growth of many plants is very poor in soils that are kept constantly wet. Both overwatered and underwatered plants suffer from the same deficiency. In one case the water is present but there is no oxygen in the soil so the roots cannot absorb water. In the other case the roots are in good condition and water could be absorbed, but there is a lack of water in the soil.

LEARNING ACTIVITIES

1. Discuss importance of soil moisture.

2. Discuss what happens if soil is kept too wet and ways to decrease it.

3. Discuss what happens if soil is kept too dry and ways to increase it.

OBJECTIVE 4. Given humidity requirement situations for plants used in hanging baskets, students will be able to select proper humidity procedures with at least 75% accuracy.

SUBJECT MATTER CONTENT

Air moisture (humidity) is very important. Unfortunately quite often it is difficult to adjust as needed. High pressure mist is a good method of adding water vapor to the air when it is needed. The mist must be so fine that it evaporates into the greenhouse air rapidly without fallout as moisture on the plants. This requires water pressure of 500 pounds per square inch or more. The evaporating water takes heat away from the surrounding air, and as a result about 10 degrees to 20 degrees F cooling can be expected. Without a high pressure mist system, about the only thing that can be done is to keep the surroundings such as walks and the areas under benches moist. This is a help, but less effective. The greenhouse air is usually too dry on summer days and even drier during the heating season. Heated air rises and deposits moisture on the underside of the glass. During the non-heating season the night air is very often too humid. The only means of correcting this problem is to provide maximum ventilation by using fan jet tubes and provide the best air circulation possible.

Growth of plants under lush humid conditions produce enlarged soft cells which is undesirable. Several kinds of disease organisms reproduce better in moist (humid) conditions, and the soft, succulent tissues are very susceptible to disease.

In dry air the water loss from plants (transpiration) may be greater than the water absorption and wilting may occur. Cell enlargement will be reduced and the plants will be shorter, the flowers and leaves smaller, and the growth rate slower.

LEARNING ACTIVITIES

1. Discuss importance of air moisture.

2. Discuss what happens if air moisture is too high and how to lower it.

3. Discuss what happens if air moisture is too low and how to raise it.

OBJECTIVE 5. Given nutrient requirement situations for plants used in hanging baskets, students will be able to select proper nutrient and fertilizer procedures with at least 75% accuracy.

SUBJECT MATTER CONTENT

A good bark mix can be made by adding additives such as peat moss, perlilte, hadite, or rice hulls. Organic matter is a good growing media. As decomposition occurs it forms substances that can absorb fertilizers and thus provide a more even supply to plants. This is known as a buffering effect. If the organic matter added to the soil is coarse enough, it will improve the drainage of water in the media. Bark and other ingredients for the most part contain very little fertilizer, and fertilizer will be required. Fertilizers should be applied at the manufacturer's rate on the bag and/or at the rate recommended by the Cooperative Extension Service. Lime requirements can also be established by a soil test from the extension service.

Vital parts of plants are made of protein, and protein cannot be made in plants unless it has nitrogen, sulfur, sugar and other elements. These materials, dissolved in water, enter the plant through the roots and are called fertilizers. Many different kinds of fertilizers are needed by plants. Some in large amounts (Primary Nutrients - nitrogen, phosphorus, and potassium), some in smaller amounts (Secondary Nutrients - calcium), and some in very small amounts (Micronutrient). The amount of fertilizer needed depends on how much fertilizer is contained in the soil as well as the stage of plant growth. To determine the quantity and quality of fertilizer required a soil test is necessary.

MATERIALS LIST

1. Two or three different fertilizer formulations, compare these.
2. Fertilizer soil analysis from Extension Service.
3. Basic soil test kit.

LEARNING ACTIVITIES

1. Discuss with class pH and what is needed to change it.
2. Discuss primary, secondary, and micronutrients and how these affect plants.
3. Discuss types of organic matter and how it improves the soil.
4. Compare different fertilizer formulations with class.
5. Study fertilizer analysis from Extension Service.
6. Conduct soil test.

OBJECTIVE 6. Given a written exam dealing with pests of plants used in hanging baskets, students will be able to provide answers with at least 75% accuracy.

Taking into account the many different varieties of hanging basket plants used today, spider mites and aphids are the most common pests. The spider mite is a tiny pest and very often one can see the result of this work before actually seeing the spider mite. The leaves turn a dull, gray-green color and appear stiff and straight. Very often the mites first start to work about midway down the plant and toward the tip of the leaf. The mite is usually found on the underside of the leaf but it is not uncommon to find the mite on the upper surface of the leaf.

Aphids are the other most likely pest to inhabit your greenhouse. Aphids are large enough to be seen quite easily and usually feed on the growing points. With these pests or others immediate action is the answer for good control. The use of pesticides can give the control needed to arrest this problem. The best way to prevent pest and disease problems is to start with clean cuttings and maintain a good sanitation program.

LEARNING ACTIVITIES

1. Discuss how pests affect plants in the greenhouse with the class.

2. Discuss the two major pest problems found in the greenhouse and methods of control.

OBJECTIVE 7. Given a written exam dealing with proper media for plants used in hanging baskets in the greenhouse, students will be able to provide answers with at least 75% accuracy.

SUBJECT MATTER CONTENT

Greenhouse "soils" must provide good growing conditions so the root is well supplied with air, water, and fertilizers. For continuous root growth the air supply in the soil must be good, and is best accomplished in soils that drain freely of water. Greenhouse baskets used for growing plants must be constructed so that water drains away rapidly and completely; therefore, the bottom tray should not be snapped on the basket until ready to be sold. The greenhouse soil should be coarse and porous. Coarse organic matter or aggregates are needed in greenhouse soils. Gravel is the coarsest and drains the best. Excellent plants can be grown in the greenhouse in gravel; however, this procedure requires close attention to watering and to the supply of fertilizers, as gravel does not retain a reserve supply of either water or fertilizer. It is best to use a bark mixture that drains well but still retains some moisture. A good bark mixture can be made by adding organic matter such as peat moss, perlite, hadite or rice hulls to fine ground pine bark. The amount and kind of organic matter to be added to the bark depends on the grade of bark used. The use of a shredder should be used sparingly because it may pulverize the bark too finely and promote poor drainage.

MATERIALS LIST

1. Perlite
2. Vermiculite
3. Gravel

4. Organic matter (manure, peat moss)

5. Hanging basket (9")

LEARNING ACTIVITIES

1. Discuss how proper media enhances plant growth.

2. Discuss organic matter materials and their functions in the media.

3. Discuss reason(s) why a shredder should not be used.

4. Prepare bark mix for hanging basket.

UNIT III TEST

1. How many foot-candles are needed for photosynthesis to take place in many plants?

   a. 60

   b. 6000

   c. 600

   d. 60000

2. Light intensity on sunny summer days may be more than _____ foot-candles.

   a. 10

   b. 1000

   c. 10000

   d. 6000

3. What are two methods of shading plants?

4. Plants grown in too _____ sunlight usually have short, heavy stems; small, light-colored leaves; and bleached flowers.

   a. strong

   b. weak

5. What steps can one take to maximize the amount of light plants receive during cloudy winter days?

6. Some plants respond to the length of day. This is referred to as _____.

7. Plant growth is usually faster at _____ temperatures.

8. How can one get good air circulation on cold days?

9. Define transpiration?

10. In order for transpiration and respiration to take place in the plant an adequate supply of _____ is needed.

11. Overwatered and underwatered plants suffer from the same deficiency. Explain.

12. _____ is very difficult to adjust in the greenhouse.

13. A high pressure mist system in the greenhouse is often used to control or regulate air moisture. This system requires water pressures of _____ pounds per square inch.

    a. 50

    b. 5

    c. 5000

    d. 500

14. Give 4 examples of organic matter.

15. What is a buffering effect?

16. Most greenhouse plants grow best in pH of about ____.

    a. 6.5

    b. 4.9

    c. 7.9

    d. 7.5

17. What are the three primary nutrients?

18. What are the two most common pests found in today's greenhouses?

19. Most pests in the greenhouse can be controlled by using ____.

    a. herbicides

    b. insecticides

    c. repellants

    d. fungicides

20. What are two of the best ways to prevent a disease problem in your greenhouse?

21. For continuous root growth the _____ supply in the soil must be good.

    a. air

    b. water

    c. nutrient

    d. earthworm

22. The greenhouse soil should be _____ and _____.

23. What is the coarsest material usually used in the greenhouse?

UNIT III TEST
ANSWER KEY

1. b

2. c

3. (1) by spraying a shady compound on the outside of the glass (2) by placing a shade cloth above the plants, or both 1 and 2

4. a

5. (1) place plants farther apart, (2) remove overhead obstacles, (3) clean glass on greenhouse, (4) use of artificial light

6. photoperiod

7. warmer

8. Let the heater heat the air while having the ventilators partly open

9. Water loss from the plants

10. water

11. In overwatering the water is available but there is so much that the roots have been damaged and the water is not taken into the plant. In underwatering the roots are in good condition and water could be absorbed, but there is a lack of water in the soil.

12. Air moisture or humidity

13. d

14. (1)peat moss, (2) straw, (3) straw manure, (4) peanut hulls

15. As organic matter decomposes it forms substances that can absorb fertilizers and thus provides a more even supply to plants.

16. a

17. nitrogen, phosphorus, potassium

18. spider mites and aphids

19. b

20. To start with disease-free cuttings and have good sanitation practices.

21. a

22. coarse and porous

23. gravel

UNIT III
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Class participation
Students' demonstrating skills on school campus or at school greenhouse
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebook

Teacher

Reference materials
Pamphlets
Fertilizer formulations
Soil analysis (Extension Service)
Perlite
Vermiculite
Gravel
Organic matter (peat moss or manure)
Hanging baskets (9")

UNIT III
SUPPLEMENTARY MATERIALS

Flower and Plant Production in the Greenhouse, Kennard S. Nelson, 1967. The Interstate Printers and Publishers, Inc., Columbus, Ohio.

Flowering Potted Plants, 34 color slides and script identifying flowering potted plants. Order number 2056S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

Greenhouse Management for Flower and Plant Production, Kennard S. Nelson, 1973. The Interstate Printers and Publishers, Inc., Columbus, Ohio.

The U. C. System for Producing Healthy Container-Grown Plants, Manual 23. Edited by Kenneth F. Baker, 1972. Agricultural Experiment Station - Extension Service.

UNIT IV
POINSETTIA PRODUCTION

INTRODUCTION

As the Christmas season approaches each year, the increased appearance of one particular plant is noticed. The poinsettia is the Christmas plant, it is often flowered for that season only and represents a major portion of the pot plant sales during the Christmas season. With a small amount of knowledge about poinsettia production, plant owners would be able to keep their plants looking better longer and have them flower again the next year.

The purpose of this unit is to provide training for the advanced students in the techniques and requirements needed to produce poinsettia flowers successfully. Due to the many variables involved in growing poinsettias, educators should only attempt this process after visiting and consulting with a local grower.

COMPETENCIES

To properly raise poinsettias as an additional source of income or pleasure.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit students should be able to:

1. Identify specific terms used in poinsettia production.
2. Identify the basic types of poinsettia production.
3. List factors involved with the light requirements and light effects on poinsettias.
4. List factors involved with temperature and humidity requirements for poinsettia production.
5. List factors involved with moisture requirements and moisture effects on poinsettias.
6. Identify the proper nutrient requirements used for poinsettia production.
7. Determine the proper growing media used in poinsettia production.

8. Determine the pests, insects and diseases which affect poinsettia production.

9. Determine the need for growth regulators in poinsettia production.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given a list of terms used in poinsettia production, students will be able to select the meaning of these terms with at least 75% accuracy.

2. Given the basic types of poinsettia production, students will be able to identify them.

3. Given a written exam on light requirements of poinsettias and effects of light on poinsettias, students will be able to list factors involved with at least 75% accuracy.

4. Given a written exam on temperature and humidity requirements for poinsettia production, students will be able to list factors involved with at least 75% accuracy.

5. Given a written exam on moisture requirements and effects of moisture on poinsettia production, students will be able to list factors involved with at least 75% accuracy.

6. Given a written exam on nutrient requirements for poinsettias, students will be able to provide answers with at least 75% accuracy.

7. Given a written exam on media for poinsettia production, students will be able to provide answers with at least 75% accuracy.

8. Given a list of insects and diseases which affect poinsettias, students will be able to identify them with at least 75% accuracy.

9. Given a written exam on growth regulants use on poinsettia production, the students will be able to define growth regulant and identify the the most common with at least 75% accuracy.

METHODOLOGY

A combination of methods can be used to teach this unit. Lecture and class discussion should be used to introduce the material and bring out specifics on poinsettia production. The instructor may then incorporate field trips to a nursery growing poinsettias, use resource persons, use demonstrations in the greenhouse, and actual poinsettia production.

SUGGESTED INTEREST APPROACHES

1. Discuss with the class potential income and pleasure from producing poinsettias.
2. Plan field trip to a nursery growing poinsettias.
3. Have resource persons discuss the opportunities involved in poinsettia production.
4. Give demonstration on propagating and producing poinsettias.

UNIT OUTLINE

I. Terms Used in Poinsettia Production

II. Types of Poinsettia Production

- A. Bench rooting
- B. Direct rooting

III. Light Requirements and Effects

IV. Temperature and Humidity Requirements

V. Moisture Requirements and Effects

VI. Nutrient Requirements

VII. Growing Media

VIII. Pest

- A. Insect
- B. Disease

1. rhizoctonia and pythium

2. pythium

3. botrytis

4. thielaviopsis

IX. Growth Regulants

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given a list of terms used in poinsettia production, students will be able to select the meaning of these terms with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Bract - A modified leaf immediately below the flower of some plants. In poinsettias it is the large red "leaf".

2. Callus - The first tissue that forms on the cut end of a cutting.

3. Cultivar - A particular variety of the poinsettia or any other plant.

4. Euphorbia pulcherrima - The scientific name for the poinsettia plant.

5. Forcing - To provide the best conditions for plant growth and to produce the crop out of season.

6. Growth Regulant - A chemical used to control plant growth and in poinsettia production a retardant is used.

7. Panning - The act of planting poinsettia plants into shallow pots called pans.

8. Photoperiod - The amount of light a plant receives in a 24 hour period.

9. Photosynthesis - The manufacturing of sugar or food in green plants from light energy.

10. Pinched - The act of removing the tip of the stem to promote lateral branching.

11. Porous - Easily drained.

12. Propagated - The reproduction of plants by seed, cuttings, budding or grafting.

LEARNING ACTIVITIES

1. Prepare a list of terms and their meanings.

2. Discuss these terms and meanings with the class.

OBJECTIVE 2. Given the basic types of poinsettia production, students will be able to identify them.

SUBJECT MATTER CONTENT

The production of poinsettias is a process which may begin as early as April and culminates with a plant ready for sale during the Christmas holidays. When beginning to grow poinsettias there are five major considerations which are very important in setting up a growing schedule. These are as follows: (1) selection of cultivars to be used, (2) size of pot and finished plant desired, (3) number of plants per pot, (4) growing habit desired (pinched or unpinched), and (5) date the plants are to be ready for sale. As a producer of poinsettias one can choose to vary any of these considerations to fit particular wants or needs. However, most rooted cuttings that are purchased and potted in July and August would produce very large plants. Cuttings for 6 inch and 7 inch pots are potted in late August or September depending upon the growth facilities and desired size of the finished plants. Generally all plants for a Christmas crop should be established in their final containers by September 25.

When producing poinsettias the producer can buy stock plants in April and produce his/her own cuttings or one may purchase callused or rooted cuttings. The cuttings should be about 4 inches and not be allowed to wilt. The cutting will root in three weeks with a 70-80 degrees F bench temperature. The use of a mist system for rooting these cuttings is highly recommended if at all possible. Panning is the process of setting the cuttings in a poinsettia pot, which is not as deep as a standard pot. The cuttings may be bench rooted or direct rooted. These two types of poinsettia production are different in the amount of work required, space required and time saved. In bench rooting, cuttings are rooted in 2 to 2 1/4 inch pots and in four to

six weeks they are repotted to the finishing pots. In direct rooting the desired number of cuttings are placed directly into the finishing pots. With either system the use of uniform cuttings is important. When panning, three plants are placed in 6 inch pots, four plants in 7 inch pots and correspondingly greater number of plants in larger pots.

Sanitation is very important in poinsettia plant production. The tools, equipment, mixes, and benches should be disinfected. Everyone who touches the plant material, should first wash their hands. A little prevention will go a long way in the production of high quality rooted cuttings.

LEARNING ACTIVITIES

1. Discuss with the class the types of poinsettia production.

2. Use a greenhouse demonstration to show the differences and similarities in the two types of production.

3. Let the students actually pan the plants themselves, using both types of production.

OBJECTIVE 3. Given a written exam on light requirements of poinsettias and effects of light on poinsettias, students will be able to list factors involved with at least 75% accuracy.

SUBJECT MATTER CONTENT

The young poinsettia plant is the same as any other plant needing a good supply of light for photosynthesis and growth to take place. But as the plant gets older, light becomes much more critical. Poinsettias are very sensitive to day length (photoperiod). Certain poinsettia cultivars require 70 consecutive days of 10 hours or less of daylight for flowers to develop into a finished plant. Many producers regulate photoperiod by giving the poinsettias artificially long days by lighting them each night for two hours from September 20 to October 5, which prevents the plant from flowering earlier than wanted. From October 5 through the time they are delivered the producer would then use a black cloth to shade the plant from all light to insure proper crop scheduling. During this period any amount of light can delay flowering. This is why many

homeowners with poinsettia plants can not get them to flower after the first year.

LEARNING ACTIVITIES

1. Discuss with the class how light affects the poinsettia plant.

2. Use the greenhouse to demonstrate the effects of light on the poinsettia plant.

3. Locate poinsettia plants from homeowners that are not flowering and use the photoperiod control system to bring them to flower.

OBJECTIVE 4. Given a written exam on temperature and humidity requirements for poinsettia production, students will be able to list factors involved with at least 75% accuracy.

SUBJECT MATTER CONTENT

Poinsettias are generally grown at night temperatures of about 60 degrees F and day temperatures of 70 degrees F. When starting the plants, a 70 degree temperature in a moist atmosphere is very beneficial, and will help the plants root and grow. A mist system should be used if possible to insure a moist atmosphere and proper humidity. As the plants get older and begin to flower, temperature directly affects the rate and color of bract development. Temperatures below 60 degrees F or above 75 degrees F for extended periods of time will shorten the life of the colorful bracts. Temperatures of 55 to 58 degrees F correctly controlled during the last two weeks of growing will produce higher quality plants. The temperature requirements for each particular cultivar must be met as close as possible.

LEARNING ACTIVITIES

1. Discuss with the class how temperature and humidity affect poinsettia plants.

2. When setting cuttings, use a greenhouse demonstration showing plants rooted with and without a mist system.

3. Provide or show pictures of poinsettia plants in flower. (Explain the beautiful colored part of the plant, which may be red, white, or pink, are the bracts and that the flowers are the tiny greenish yellow nubs in the center of these bracts.)

OBJECTIVE 5. Given a written exam on moisture requirements and effects of moisture on poinsettia production, students will be able to list factors involved with at least 75% accuracy.

SUBJECT MATTER CONTENT

Pot size, pot type, soil mix and environmental conditions will all affect the amount and frequency of watering. Poinsettias are very susceptible to root and stem diseases that are promoted by water logged conditions. Plants should be checked frequently and care should be taken to make sure the soil dries somewhat between waterings. When the soil is dry at the top, water the plant until it becomes moist again. The key is not to overwater and cause disease problems.

LEARNING ACTIVITIES

1. Discuss with the class the moisture requirements of poinsettia plants.

2. Show the class the proper way to tell when water is needed and how much to water.

3. Find diseased plants and show the effects of too much moisture on the poinsettia plant.

OBJECTIVE 6. Given a written exam on nutrient requirements for poinsettias, students will be able to provide answers with at least 75% accuracy.

SUBJECT MATTER CONTENT

Poinsettias need a continuous supply of fertilizer. They also require higher amounts of nitrogen than phosphorous and potassium. Adding some fertilizer with each watering by means of a fertilizer injector is a good way to

make sure of a constant supply of fertilizer. Fertilizers such as 25-0-25 or 25-5-20 are suitable for poinsettia plants and should be applied at least every two weeks at the rate of 3 pounds of 25-0-25 or 25-5-20 per 100 gallons of water if an injector is not used. A fertilizer schedule for the particular cultivar being grown should be obtained and adhered to closely.

LEARNING ACTIVITIES

1. Discuss with the class how fertilizer affects the poinsettia plant.

2. Demonstrate the various methods of fertilizer application.

3. Present each of the students with a fertilizer schedule for the particular cultivar being grown by them.

OBJECTIVE 7. Given a written exam on media for poinsettia production, students will be able to provide answers with at least 75% accuracy.

SUBJECT MATTER CONTENT

Best root development and overall plant growth occurs in a very porous growing medium. The best pH for the growing medium is between 4.5 and 6.0. A well drained soil mixture using a mixture of sand, light loam soil, peat, and perlite in about equal proportions will work well. Soilless mixes are better since the ingredients are uniform and are sterile. It is highly recommended to use a commercial soilless mix or prepare your own soilless mix. The key is to make sure the growing media is very porous, so that water logged soils do not occur. All soil and equipment should be sterilized to prevent soil-borne diseases.

LEARNING ACTIVITIES

1. Discuss with the class the proper growing media and its effects upon poinsettia production.

2. Prepare a soilless mix, demonstrating to the students the mixture and procedure for obtaining the mixture.

3. Water the soil to demonstrate how water affects it.

4. Take a sample of the soil and send it off to the Cooperative Extension Service to get a pH evaluation of the mixture prepared.

OBJECTIVE 8. Given a list of insects and diseases which affect poinsettias, students will be able to identify them with at least 75% accuracy.

SUBJECT MATTER CONTENT

When looking at pests which affect the poinsettia plant there is one insect of significant importance and four diseases. The insect being the whitefly and the diseases are Rhizoctonia, Pythium, Thielaviopsis, and Botrytis. The control of the whitefly is not difficult, but it should be eradicated in the early stages, since most of the insecticides will bleach and damage the bracts.

Rhizoctonia, Pythium, and Botrytis are diseases which can cause stem and/or root rot. To control these diseases sanitation is a must. Propagation benches, soil, used pots, and handling equipment need to be thoroughly steam sterilized. Many growers also use a preventive drench of Truban or a mixture of Dexon and Terraclor to eliminate the problem with Rhizoctonia and Pythium. Botrytis is controlled with Termil, Daconil, Tutane, Captan or Benlate.

Thielaviopsis develops more easily at temperatures below 60 degrees F, and this is one reason why it is hazardous to drop the temperature in the greenhouse at anytime. The most common symptoms of this disease are loss of roots and loss of the lower leaves. The fungicides Ferbam and Benlate are used to control Thielaviopsis.

LEARNING ACTIVITIES

1. Discuss with the class how pests affect the poinsettia plant.

2. Take field trip to a nursery which produces poinsettias and have the owner discuss the losses which these pests cause.

3. If possible show these pests to the students so they know what to look for.

OBJECTIVE 9. Given a written exam on growth regulants use on poinsettia production, the students will be able to define growth regulant and identify the most common with at least 75% accuracy.

SUBJECT MATTER CONTENT

Growth regulants are chemicals used to retard the growth of some poinsettia plants. It is used mainly on those plants which are growing too tall and must be stopped. The most acceptable height of poinsettia plants is 12 to 15 inches above the pot. Cycocel is a growth regulant which has been used very successfully on the poinsettia. A solution of 1.5 ounces of Cycocel per gallon is sprayed on the foliage to run off on the crop before October 15 and repeated seven to ten days later. Any applications made later than this may cause the flowers to be reduced in size and deformed. The treated plants should be shorter, with heavier stems and greener foliage.

LEARNING ACTIVITIES

1. Discuss with the class what growth regulants are and their effects on the poinsettia plant.

2. Demonstrate the proper way to mix and apply Cycocel.

3. Show pictures of or actual plants, with and without growth regulants being used.

UNIT IV TEST

1. Matching (match the word with its definition)

_____1.	Bract	_____7.	Panning
_____2.	Callus	_____8.	Photoperiod
_____3.	Cultivar	_____9.	Photosynthesis
_____4.	Euphorbia pulcherrima	_____10.	Pinched
_____5.	Forcing	_____11.	Porous
_____6.	Growth regulant	_____12.	Propagated

a. A chemical used to control plant growth and in poinsettia production a retardant is used.

b. Reproduction by seed, cuttings, budding or grafting.

c. To provide the best conditions for plant growth and to produce the crop out of season.

d. Easily drained.

e. Scientific name of the poinsettia.

f. Removing the tip to promote lateral branching.

g. A particular variety.

h. Manufacturing of sugar or food in green plants from light energy.

i. First tissue on the cut end of the cutting.

j. Amount of light a plant reserves in a 24 hour period.

k. A modified leaf immediately below the flower of some plants. In poinsettias it is the large red "leaf".

l. The act of planting poinsettia plants into shallow pots called pans.

2. List the two types of poinsettia production.

(1) (2)

3. List the light requirements for poinsettia production.

4. List the temperature requirements for poinsettia production.

   (1)

   (2)

5. List the four factors that affect moisture requirements for poinsettia production.

   (1)

   (2)

   (3)

   (4)

6. What are the nutrient requirements for poinsettia production?

7. What is the proper growing media for poinsettia production?

8. Identify the pests which follow as being (A) Insect or (B) Disease.

   1. Rhizoctonia _____

   2. Thielaviopsis _____

   3. Whitefly _____

   4. Pythium _____

9. Define what a growth regulant is and identify the most common regulant for poinsettia production.

   (1)

   (2)

UNIT IV TEST
ANSWER KEY

1. Matching

   1. k
   2. i
   3. g
   4. e
   5. c
   6. a
   7. l
   8. j
   9. h
   10. f
   11. d
   12. b

2. (1) Bench Root

   (2) Direct Root

3. 70 consecutive days of 11 hours or less of daylight

4. (1) Night temperatures of 60 degrees F

   (2) Day temperatures of 70 degrees F

5. (1) Pot size

   (2) Pot type

   (3) Soil mix

   (4) Environmental conditions

6. A continuous supply of fertilizer with higher amounts of nitrogen than phosphorous and potassium

7. A very porous growing medium with a pH between 5.5 and 6.0

8. (1) Disease

(2) Disease

(3) Insect

(4) Disease

9. (1) A chemical used to retard the growth of a plant

(2) Cycocel

UNIT IV
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Class participation and discussion
Students' demonstrating skills in the greenhouse or nursery
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebook

Teacher

Reference material
Handouts
Overhead projector
Transparencies
Greenhouse
Poinsettia plants

UNIT IV
SUPPLEMENTARY MATERIALS

Favorite Houseplants - And How to Grow Them, Better Homes and Garden, Meredith Corporation, 1976.

Flower and Plant Production in the Greenhouse, Kennard S. Nelson, Interstate Printers and Publishers, Inc., 1967.

Greenhouse Management for Flower and Plant Production, Kennard S. Nelson, Interstate Printers and Publishers, Inc., 1973.

Growing Beautiful Flowers Indoors, Jack Kramer, St. Martin's Press, 1980.

1001 House Plant Questions Answered, Stanley Schuler, D. Van Nostrand Company, Inc., 1963.

Poinsettia Production, Task sheets for production.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

Poinsettias, 97 color slides and script covering all aspects of production, order number 2048S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, Columbus, Ohio 43210-1099

The Greenhouse Grower - A Career in Floriculture, Kennard S. Nelson, Interstate Printers and Publishers, Inc., 1977.

The Poinsettia Manual, Edited by Paul Ecke, Jr., Paul Ecke Poinsettias, 1976.

UNIT V
VEGETABLE BEDDING PLANT PRODUCTION: TOMATOES, PEPPERS AND EGGPLANTS

INTRODUCTION

Many of our school programs do not take advantage of the unique opportunity to raise vegetables and sell them in the community as a major fund raiser. By working in a greenhouse and producing transplants, students will gain experience in all phases of vegetable production. Students are rewarded daily by experiencing the actual success of their endeavors. Some may bring in additional income by starting their own greenhouse operation.

The purpose of this unit is to provide a basis for growing vegetable plants successfully in a greenhouse.

COMPETENCIES

To develop skills in a greenhouse operation, to produce healthy transplants for the home garden and provide a basis for income.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Prepare a good medium, select suitable varieties, and sow seeds efficiently.
2. Transplant with a high rate of success.
3. Identify insects and diseases.
4. Maintain and control proper environment for plant growth.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given a written exam, students will be able to determine factors involved with mixing good growing media with at least 75% accuracy.
2. Given a controlled number of good vegetable seeds, students will plant and produce seedlings and have at least a 75% rate of germination.

3. Given a controlled number of vegetable seedlings, students will transplant the seedlings with at least 75% success.

4. Given a written exam, students will be able to list diseases and insects that affect vegetable plants with at least 75% accuracy.

METHODOLOGY

A combination of classroom instruction, greenhouse demonstrations and exercises should be used to teach this unit. Slides or other video aids are needed to teach identification of insects and diseases.

SUGGESTED INTEREST APPROACHES

1. Plan visit to a nearby nursery.
2. Visit local gardens.
3. Discuss with class potential income.
4. Discuss job availabilities.
5. Give students free plants to start home garden.
6. Use resource persons.

UNIT OUTLINE

I. Basic Soil Requirements
   - A. Soil media
   - B. Recommended mixtures
   - C. Soil sterilization or pasteurization

II. Bedding Plants
   - A. Sowing dates
   - B. Sowing seeds
   - C. Maintain seed bed

III. Germination of Seeds

A. Hotbed

B. Greenhouse

IV. Transplanting

V. Diseases

A. Bacteria

B. Fungi

C. Viruses

D. Nematodes

E. Environmental

VI. Disease Prevention and Control

VII. Insects

A. Classification

B. Control

C. Types

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given a written exam, students will be able to determine factors involved with mixing a good growing media with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Factors to Consider in Mixing Soil Media

1. Pore space

2. Soil structure

3. Soil texture

4. Organic matter

5. Available nutrients

6. Disease organisms

B. Recommended Mixtures

1. Common soil mixtures should be well-drained, aerated and have good water-holding capacity.

2. A good seeding mixture may be obtained by mixing topsoil with high proportions of perlite, vermiculite and/or peat. One-third of each is a good starting point.

C. Soil Sterilization/Pasteurization

1. Heat treatment - heating soil to 180 degrees F for a minimum of 30 minutes will eliminate many unwanted pests, disease organisms and weeds. The steam method is most widely used to pasteurize the mix. Sterilization at higher temperatures and longer times should be avoided due to toxic substances which may be produced from heating.

2. Chemical treatments

   a. Methyl Bromide

   b. Vapam

3. Selection - buy soil labeled sterile.

LEARNING ACTIVITIES

1. Prepare a soil media for vegetables.

2. Mix samples in your greenhouse. Consider the soil factors.

3. Discuss the importance of sterilization and pasteurization.

4. Use a greenhouse demonstration.

OBJECTIVE 2. Given a controlled number of good vegetable seeds, students will plant and produce seedlings and have at least a 75% rate of germination.

SUBJECT MATTER CONTENT

A. **Vegetable Plants Sowing Dates for a Spring Crop in Louisiana**

1. **Eggplants - January 15***

2. Tomatoes - January 1 - 15

3. Peppers - January 15

*If greenhouse is cool eggplants and peppers should be sown January 1.

B. Sowing Seeds

1. Seeds are normally planted in rows.

2. Rows are spaced approximately 2" apart.

3. Sticks or cleats may be used to make rows.

4. Seed depth depends upon:

   a. variety

   b. size - generally small seeds are planted shallow and large ones are planted at a depth of 2 1/2 to 3 times the diameter of the seed.

5. Varieties

   a. see Appendix A

C. Maintaining Seed Beds

1. As seeds are covered, water carefully.
   Note: seed bed should be completely wet.

2. Seed beds should not be allowed to dry out -- maintain moisture by covering with newspaper or glass. Once germination commences, the covering should be removed.

3. Eighty degrees F is recommended for germination of many vegetable varieties.

D. Germination of Seeds

1. Hotbeds are usually constructed of wood or other building materials.

2. Hotbeds are generally supplied with heat to reduce germination time.

   a. by using electric heating, soil is placed over the electrical coils and thermostats are used to maintain proper temperature.

3. Cold frames unlike hotbeds are germination structures in which no artificial heat is used.

E. Rate of Germination - Varies with Conditions

1. Eggplants - 8-14 days

2. Peppers - 5-10 days

3. Tomatoes - 4-8 days

LEARNING ACTIVITIES

1. Lead a discussion of sowing dates, seed preparation, soil media and planting boxes.

2. Given sample counts, allow students to plant and maintain records.

3. Lead a discussion of hotbeds.

4. Give a greenhouse demonstration.

OBJECTIVE 3. Given a controlled number of vegetable seedlings, students will transplant the seedlings with at least 75% success.

SUBJECT MATTER CONTENT

A. Transplanting

1. Plants should be removed from flats after first true leaves develop.

2. Individual containers such as peat pots are frequently used.

3. Fertilizers - Use a high quality well-balanced fertilizer.

B. Hardening Plants - Refers to the strengthening of plant tissues

1. Use of cold frames.

2. Exposing them to lower than normal temperatures.

3. Allowing the soil of the plant bed to become dry.

4. Increasing light intensity.

5. Reducing fertilizer, especially nitrogen.

6. Combination of 2, 3, 4 and 5.

LEARNING ACTIVITIES

1. Lead a discussion of transplanting techniques.

2. Give a greenhouse demonstration.

3. Give students a controlled number of vegetable plants to transplant and determine the success rate.

4. Discussion of hardening plants.

5. Repeat #3 and use seedlings which are too young or too old to transplant and determine the success rate.

OBJECTIVE 4. Given a written exam, students will be able to list diseases and insects that affect vegetable plants with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Diseases

A. Common vegetable diseases - five types of pathogens that cause disease in plants include:

1. Bacteria - small one-celled microorganism

a. Cocci - round

b. Spirilla - spiral-shaped

c. Bacille - rod-shaped

*Symptoms of bacterial infections include as follows: galls, blights, wilts and rots.

2. Fungi - frequently transmitted by water, and to a lesser extent by insects or seeds. Fungi reproduce by the formation of microscopic bodies called spores and are prevalent in conditions of high humidity and high temperature.

    a. Fusarium wilt

    b. Powdery mildew

    c. Anthracnose

3. Virus - non-living disease agents so small only an electron microscope makes them visible.

    a. transmitted by insects, nematodes, soils, seeds, and tools.

    b. examples

        1. mosaics - causes molting, spotting, loss of color of plant tissue and reduces yield frequently affects tomatoes.

        2. yellows - yellowing of plant parts, dwarfing, curling of leaves, gall formation and reduces yield.

4. Nematodes - round worms that live in soil or water - usually attack plant roots - permit invasion of other organisms.

    a. symptoms include: abnormal enlargement of root cells or galls, unhealthy foliage, pale color, dwarfing, wilting and occasionally death of plant.

5. Environment - nutrition deficiency

B. Disease prevention and control

1. Use of resistant varieties.

2. Use of disease-free seed.

3. Seed treatment

4. Soil treatment

5. Quarantine

6. Use of proper and balanced fertilizers.

C. Control

1. Dust

2. Wettable powders

3. Liquids

D. Appendix B - Diseases of Vegetables in Greenhouses

II. Pests

A. Common pests

1. mites

2. aphids

B. Prevention

1. keep area free of weeds

2. optimum climatic conditions

C. Control - chemicals (depends on actual pest) examples include:

1. malathion

2. kelthane

3. thiodan

LEARNING ACTIVITIES

1. List diseases and insects and show examples of each.

2. Lead a discussion of control and prevention.

3. Give a greenhouse demonstration.

APPENDIX A
Recommended Vegetable Varieties in Louisiana

I. Tomatoes

- A. Large types
  - 1. Fantastic
  - 2. Better Boy
  - 3. Pelican*
  - 4. Creole
  - 5. Floradel
  - 6. Park's Extra Early
  - 7. Celebrity*
- B. Canning types
  - 1. Chico III
  - 2. Saladette

*Nematode Resistant

II. Hot Peppers

- A. Jalapeno
- B. Cayenne
- C. Tabasco
- D. Chili
- E. Gold Spike

III. Sweet Peppers

- A. Keystone Resistant Giant No. 3 and No. 4
- B. Bell Boy
- C. Yolo Wonder
- D. California Wonder

IV. Eggplants

A. Classic

B. Florida Hi Bush

C. Blackbell

D. Blacknite

E. New Orleans Market

F. Green Eggplants

APPENDIX B
Common Diseases Found in Vegetable Plants

1. Fusarium Wilt
2. Bacterial Wilt
3. Early Blight
4. Root Knot
5. Damping off
6. Virus Diseases
   a. Tobacco Mosaic
   b. Curly Top

UNIT V TEST

1. Four factors to consider in mixing a soil media for greenhouse vegetable production are _____, _____, _____ and _____.

2. What is the most widely used method of pasteurizing soil in greenhouse vegetable production?

3. What are the recommended seed sowing dates in order to have transplants near the last frost dates in Louisiana for the following plants? Give dates for both North and South Louisiana.

   A. Eggplants:

   B. Tomatoes:

   C. Peppers:

4. What are five methods of hardening plants grown in a greenhouse to facilitate successful transplanting?

5. Five types of pathogens that cause disease in greenhouse vegetable production are _____, _____, _____, _____ and _____.

6. Three pesticides used in greenhouses to control pests are _____, _____, and _____.

7. Two symptoms of bacterial infection on greenhouse plants are _____ and _____.

8. What planting practice is used to speed up the germination time required by greenhouse plants?

9. How does one determine when to transplant greenhouse vegetables?

10. Two common diseases found in vegetable plants are _____ and _____.

UNIT V TEST
ANSWER KEY

1. Pore space, soil structure, soil texture, organic matter, available nutrients, disease organisms

2. Steaming

3. A. January 15

   B. January 20

   C. January 1

4. A. Use of cold frames

   B. Exposing the plants to lower than normal temperatures

   C. Allowing the soil of the plant bed to become dry

   D. Increase light intensity.

5. Bacteria, fungi, virus, nematodes, environment (nutrient deficiency)

6. Malathion, Kelthane, Thiodan

7. Galls, blight, wilt, rot

8. Hotbeds

9. First set of true leaves

10. Fusarium wilt, bacterial wilt, early blight, root knot, damping-off, tobacco mosaic, curly top

UNIT V
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Give students a controlled number of good vegetable seeds, have students properly plant them and determine the germination rate of each student planting
Demonstrate the skills of mixing a growing media, maintaining seedlings and transplanting
Give students a controlled number of vegetable seedling for transplanting. Determine the number that are correctly transplanted.
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebook
Availability of greenhouse supplies

Teacher

Reference material
Extension Service pamphlets
Overhead projector
VCR
Transparencies
Greenhouse supplies and equipment

UNIT V
SUPPLEMENTARY MATERIALS

A Basic Program in Plant Science. Louisiana State Department of Education and LSU School of Vocational Education, 1969 Unit IV.

Ahlgren, H. L., R. J. Delorit, L. J. Greub. Crop Production. 4th Edition, Prentice Hall, Inc., Englewood Cliffs, N.J. 1974. Ch. 2.

Bedding Plant Equipment, 36 color slides and script, order number 2092S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

Bedding Plant Production, Task sheets, order number 2208L.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

Bedding Plants, 49 color slides and script, order number 2092S.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

Donahue, Ray L., Roy H. Follett, Rodney W. Tulloch. Our Soils and Their Management. 4th Edition, Interstate Printers and Publishers, Inc. 1976.

How to Grow Plants in a Greenhouse, videotape, order number 6-041-111G.

Available From: Vocational Education Productions, California Polytechnic State University, San Luis Obispo, CA 93407

Louisiana Vegetable Planting Guide. LSU Cooperative Extension Service.

Tips and Growing Bedding Plants, 36 page Bulletin, order number 226X.

Available From: Ohio Agricultural Education Curriculum Materials Service, Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

Vegetable Crops. Thompson, H. C. and William C. Kelly, 1957, McGraw-Hill Book Company, New York.

Vegetable Gardening Hints - Tomatoes, Peppers, Eggplants, LSU Cooperative Extension Service.

Ware, W. W., J. P. McCollum, Producing Vegetable Crops. Second Edition. Interstate Printers and Publishers, Inc. 1975.

UNIT VI
PRODUCTION OF POTTED CHRYSANTHEMUMS

INTRODUCTION

Mums (Chrysanthemum X morifolium) are one of the best selling flowering plants due to their durability qualities. These flowers are popular because there is a wide selection. Colors range from white to yellow, pink, lavender, bronze and red. In addition to the many colors there are several forms available to suit various occasions.

There are many factors involved in the production of chrysanthemums. Educators should only attempt growing chrysanthemums after having visited a mum producer and evaluating his/her growing structures and expertise. A crop of high-quality mums is most rewarding to any producer.

COMPETENCIES

To properly produce potted mums and provide a healthy growing environment.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Identify correct growing procedures for potted mums.
2. Identify environmental factors which affect the growth of mums.
3. Determine when to plant and market mums.
4. Identify problems incurred when planting and growing mums.
5. Identify different types of mums.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given a written exam on the different types of mums, students will be able to identify the types with at least 75% accuracy.

2. Given a list of the growing procedures for mums, students will be able to select correct procedures from the list with at least 75% accuracy.

3. Given a list of environmental factors which affect the growth of mums, students will be able to list these factors with at least 75% accuracy.

4. Given a list of when to plant and market mums, students will be able to complete the list with at least 75% accuracy.

5. Given a list of problems incurred when planting and growing mums, students will be able to complete the list with at least 75% accuracy.

METHODOLOGY

A combination of methods could be used in teaching this unit. The instructor may incorporate field trips to a nursery or commercial greenhouse, resource persons, or utilize an independent study to broaden the students' knowledge of growing mums. Lecture and class discussion can also be used to bring out problems and procedures.

SUGGESTED INTEREST APPROACHES

1. Plan field trip to a nursery or commercial greenhouse.

2. Discuss with class the potential income from producing potted mums.

3. Allow students to take home the plants they grow.

UNIT OUTLINE

I. Common Types of Chrysanthemums

   A. Daisy spray mums

   B. Anemone spray mums

   C. Decorative spray mums

   D. Incurve standard mums

   E. Spider standard mums

F. Button spray mums

G. Spoon mums

II. Growing Procedures

A. Media

B. Potting

C. Watering

D. Fertilizing

III. Environmental Factors

A. Temperature

B. Moisture

C. Light

IV. Planting and Marketing Schedule

V. Problems Incurred

A. Improper growing conditions

B. Diseases

C. Insects

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given a written exam on the different types of mums, students will be able to list the types with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Types of Chrysanthemums

1. Daisy spray mums

2. Anemone spray mums

3. Decorative spray mums

4. Incurve standard mums

5. Spider standard mums

6. Button spray mums

7. Spoon mums

LEARNING ACTIVITIES

1. Show slide presentation on potted mums.

2. Discuss the difference between the flowers of the different types of mums as indicated on the slides.

3. Discuss the difference between a mum floret and a mum flower.

OBJECTIVE 2. Given a list of the growing procedures for mums, students will be able to select correct procedures from the list with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Steps to Follow

1. Select a suitable growing media.

2. Select disease and insect-free cuttings.

3. Plant cuttings shallow.

4. Fertilize.

5. Water.

LEARNING ACTIVITIES

1. Show the class a suitable media for growing mums.

2. Discuss the difference between disease and insect-free cutting and those that are infested.

3. Demonstrate the correct way to plant cuttings.

4. Let the students plant cuttings and discuss the procedures as they go.

5. Discuss how to fertilize, water and care for the mums.

OBJECTIVE 3. Given a written exam on environmental factors which affect the growth of mums, students will be able to list these factors with at least 75% accuracy.

SUBJECT MATTER CONTENT

A. Environmental Factors

1. Temperature

2. Moisture

3. Light

LEARNING ACTIVITIES

1. Discuss with class how environmental factors affect mums.

2. Describe major environmental factors that affect the growing of mums.

3. Discuss with the class how to control flowering by altering the day length.

OBJECTIVE 4. Given a list of when to plant and market mums, students will complete the list with at least 75% accuracy.

SUBJECT MATTER CONTENT

Pot mums require approximately three months to produce, in addition to the rooting time. Mums may be classified according to flower type, or to the time required to flower (9, 10, or 11 week varieties). Depending on the vareity, 9, 10 or 11 weeks later after the plants are placed on short days, flowering should occur. Variety response can be obtained from the producers of mum cuttings.

Tip cuttings should be rooted under long days at the appropriate time by counting back from the harvest date. The growing time is determined by the specific varieties grown. Generally mums are propagated and grown under long

days until the desired height is reached, and then grown under short days until flowering. Mums require 9 1/2 hours of darkness to initiate flower buds, and 10 hours to develop the floral buds.

Graded cuttings are planted shallow and near the edge of the pot. Proper planting and spacing allows for good aeration around the roots, and adequate light to promote branching. Close observation in regards to humidity and overwatering is required for 7 to 10 days or until the cuttings are rooted into the mix. Pot mums are typically pinched when approximately 10 leaves can remain on the plant. Soft pinching encourages shoots or branches to form, and consequently more flowers are produced.

Certain varieties of mums may grow tall and will require a growth retardant. Retardants such as B-Nine, and Phosfon are frequently used.

To control or regulate the vegetative growth and flowering of mums the day/night length must be regulated. Vegetative growth is maintained by growing the plants on long days (dark period no longer than 9 1/2 hours) either by natural or artificial light. The use of artificial light, to keep the plant vegetative, can be achieved by utilizing common 60-watt incandescent light bulbs spaced four feet apart and two feet above the plants. During certain periods of the year it may be necessary to shade (create short days) the mums to promote flowering during naturally long day periods. Shading/short days may be artificially created by pulling a black cloth daily over the plant to initiate floral induction.

LEARNING ACTIVITIES

1. Discuss with class the various production schedules for mums and how mums can be flowered any time by controlling day length.

2. Discuss with class when mums should be marketed and packaged.

OBJECTIVE 5. Given a list of problems incurred when planting and growing mums, students will be able to complete the list with at least 75% accuracy.

SUBJECT MATTER CONTENT

Troubles with chrysanthemums may range from physiological disorders to diseases and insects. Common diseases include: stem rots, powdery mildew, and gray mold.

Rhizoctonia frequently causes stem rot, if the rooted cuttings are planted too deep or if the soil is poorly drained. Typically Rhizoctonia shows up as dead areas near the soil line. Various fungicides such as Terraclor and others may be used to control this disease. Always consult your county agent for the most current recommendations.

Botrytis blight, or otherwise known as gray mold, causes the petals to turn brown and water soaked. Specific areas may develop gray spore masses. Normally good air circulation to control humidity will correct this problem. Chemicals such as Maneb, Captan, and/or Zineb may be used as a spray in the control of gray mold.

Another disease, which may be a problem under conditions of high humidity, is powdery mildew. This disease appears as a white fungus normally found on the leaves. Benlate may be used to control powdery mildew in addition to humidity reduction.

Common pests such as aphids, caterpillars, spider mites, and leaf miners attack mum plants. Aphids may be controlled with malathion or orthene. Sevin powder or dust along with thiodan or orthene may be utilized to control caterpillars. Spider mites and leaf miners are somewhat difficult to control. Kelthane, Plectran, or Vendex is used for spider mites. To control leaf miners the chemicals Diazinon or Pounce are utilized.

LEARNING ACTIVITIES

1. Discuss proper and improper growing conditions with students.

2. Discuss the prevention and control of diseases and insects.

3. Discuss how diseases and insects affect the growth of mums.

UNIT VI TEST

1. List four types of mums:

   a.

   b.

   c.

   d.

TRUE OR FALSE -- CIRCLE CORRECT ANSWER

2. T F A pasteurized, loose, and well-drained growing media should be used.

3. T F Cuttings should be planted deep in the growing media.

4. T F Light has no effect as to when mums will flower.

5. T F Mums do not grow well in very high temperatures.

6. T F Mums should be sent to the market when the flowers are fully open.

7. T F Diseases are easier to prevent than control.

8. T F Insects are no threat to mums.

9. T F Mums grow best in the Fall.

10. T F Mum cuttings should be planted deep to promote establishment.

11. List three environmental factors that affect the growth of mums:

    a.

    b.

    c.

12. In addition to rooting, pot mums require _____ time to produce a sellable crop.

13. Mums may be classified by:

    a.

    b.

14. Long days may be artificially provided by _____.

15. Common diseases of chrysanthemums include:

    a.

    b.

    c.

16. List four pests of chrysanthemums, and include a recommended control of each.

	Pest	Control
a.	_____	_____
b.	_____	_____
c.	_____	_____
d.	_____	_____

UNIT VII TEST
ANSWER KEY

1. a. Daisy spray mums

   b. Anemone spray mums

   c. Decorative spray mums

   d. Incurve standard mum

   or

   e. Spider standard mums

   f. Button spray mums

   g. Spoon nums

2. True

3. False

4. False

5. True

6. False

7. True

8. False

9. True

10. False

11. a. Temperature

    b. Moisture

    c. Light

12. three months

13. a. time required to flower

    b. flower type

14. utilizing 60 watt incandescent light bulbs spaced four feet apart, two feet above the plants

15. a. stem rots

    b. Botrytis blight or gray mold

    c. powdery mildew

16. a. aphids -- malathion or orthene

    b. cutworms -- sevin or thiodan or orthene

    c. spider mites -- kelthane or plectran or vendex

    d. leaf miner -- diazinon or pounce

UNIT VI
EVALUATION AND TESTING

Ways to Evaluate Pupils Growth

Class participation
Skills demonstrated in the greenhouse or shop
Unit test

EQUIPMENT AND SUPPLIES

Student

Notebook

Teacher

Reference materials
Slide projector
Slide presentation on mums
Growing media
Mum cuttings
Growing pots
Fertilizer

UNIT VI
SUPPLEMENTARY MATERIALS

Chrysanthemums, LSU Cooperative Extension Service.

Flower and Plant Production in the Greenhouse, by Nelson; 3rd edition, pp. 237-244.

Introductory Horticulture, Reiley and Shry, pp. 169-180.

The Ball Red Book, 13th edition, pp. 246-256, 275-290.

The Commercial Greenhouse, Boodley, pp. 288-294.

UNIT VII
FLOWERING POT PLANTS

INTRODUCTION

There has been a large increase in the growing and selling of flowering pot plants during recent years. Even though more plants are being sold, most Americans are unsure of how to care for their newly purchased plants. Few growers are familiar with the techniques or specialized equipment which are used to produce a sellable product.

The purpose of this unit is to provide students with functional knowledge pertaining to greenhouse production of common flowering pot plants.

COMPETENCIES

To master important data dealing with the production of greenhouse flowering pot plants.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Identify the various propagation techniques.
2. Identify the environmental factors which affect the growth of flowering pot plants.
3. Identify basic requirements for plant life such as nutrients and media.
4. Identify various pests and diseases related to foliage plants.
5. Identify plant forcing techniques that are used in greenhouse flower pot production.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Students will be able to match the propagation methods with a particular flowering pot plant. This must be mastered at a rate of 75% or greater.
2. Given a particular flowering pot plant, the student will be able to identify an appropriate media with at least 75% accuracy.

3. Given a particular flowering pot plant, the student will be able to select the proper light intensity from four choices. This must be mastered at a rate of 75% or greater.

4. Given a particular flowering pot plant, the student will be able to select the proper temperature from four choices with at least 75% accuracy.

5. Given a particular flowering pot plant, the student will be able to identify the proper forcing techniques with at least 75% accuracy.

6. Given a particular flowering pot plant, the student will be able to identify the optimum media moisture with at least 75% accuracy.

7. Given a particular humidity, the student will be able to identify plants for which this represents the ideal growing humidity with at least 75% accuracy.

8. Given a particular flowering pot plant, the student will be able to identify its fertilizer requirements with at least 75% accuracy.

9. Students will be able to list or identify the pests and diseases which are most commonly associated with a particular flowering pot plant. This must be mastered at the rate of 75% or greater.

METHODOLOGY

Various methods of instruction can be used in teaching this unit. For example, the instructor may supplement the material covered in class with hands-on experiences obtained through the use of the school's greenhouse. He/she may also plan field trips to commercial greenhouses or call on the service of professionals in this field to supplement his/her lesson plans. Lectures and class discussions may also include inquiries of various basic problems and procedures.

SUGGESTED INTEREST APPROACHES

1. Plan field trip to a local greenhouse facility that grows flowering pot plants.

2. Discuss the job market and possible income involved with producing flowering pot plants.

UNIT OUTLINE

A. Propagation Techniques

B. Environmental Factors

1. Light
2. Temperature
3. Moisture
4. Humidity

C. Other Basic Requirements for Plant Life

1. Nutrients
2. Media
3. Pests and diseases

D. Forcing Techniques

E. Equipment

F. Grading

G. Marketing or Selling Product

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Students will be able to match the propagation methods with a particular flowering pot plant. This must be mastered at a rate of 75% or greater.

SUBJECT MATTER CONTENT

I. Propagation*

A. Azaleas

1. tip cuttings of new growth

*Rooting hormone will shorten the propagation period for any one of these cuttings.

2. mist system required

B. Begonias

1. seeds or tip cuttings

C. Geraniums

1. tip cuttings of new growth

D. African Violets

1. leaf-petiole cuttings

E. Hydrangeas

1. tip cuttings of new growth

2. mist system is beneficial

F. Gloxinias

1. seeds or tubers

LEARNING ACTIVITIES

1. Explain why a corresponding propagation method best suits a particular flowering pot plant.

2. Discuss the basic steps which must be taken on the propagation of each flower plant type.

OBJECTIVE 2. Given a particular flowering pot plant, the student will be able to identify an appropriate media with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Media

A. Azaleas

1. straight coarse grade of sphagnum peat moss

2. pH of 5.0 - 5.5

B. Geraniums, African Violets, Gloxinias

1. 1 part peat, 2 parts pasteurized potting soil or fine ground pine bark, 1 part sand

2. pH of 6 - 7

C. Hydrangeas

1. 1 part peat, 2 parts pasteurized or fine ground pine bark potting soil, 1 part sand

2. pH of 5 or 6.5

a. 5 will result in blue flowers on certain cultivars.

b. 6.5 will result in pink flowers on certain cultivars.

D. Begonias

1. 1 part peat, 2 parts pasteurized potting soil or fine ground pine bark, 1 part sand

2. pH of 5.5 - 6.0

LEARNING ACTIVITIES

1. Distribute handouts on the possible constituents of a potting mixture.

2. Discuss the desirable characteristics of a potting media.

OBJECTIVE 3. Given a particular flowering pot plant, the student will be able to select the proper light intensity from four choices. This must be mastered at a rate of 75% or greater.

SUBJECT MATTER CONTENT

I. Light Intensity

A. Azaleas

1. at least 4 hours of direct sun -- 4,000 foot-candles

B. Begonias

1. bright indirect sun -- 1,5000 - 3,000 foot-candles

C. Geraniums

1. at least 4 hours of direct sun -- 3,000 - 4,000 foot-candles

D. African Violets

1. low light requirement -- 900 - 1,200 foot-candles

E. Hydrangeas

1. bright indirect sun -- 3,000 foot-candles

F. Gloxinias

1. bright indirect sun -- 2,000 - 2,500 foot-candles

LEARNING ACTIVITIES

1. Discuss the appearance of a flowering pot plant that was allowed to grow under too little or too much light.
2. Explain the term foot-candles.
3. Discuss the use of supplemental or artificial light.

OBJECTIVE 4. Given a particular flowering pot plant, the student will be able to select the proper temperature from four choices with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Temperature

A. Azaleas

1. night temperature of 40-45 degrees F and day temperature of 68 degrees F and lower

B. Begonias

1. night temperature of 50-60 degrees F and day temperature of 68-72 degrees F

C. Geraniums

1. 62 degrees F minimum night temperature and maximum day temperature of 75 degrees F

D. African Violets

1. 70 degrees F minimum night temperature and 80 degrees F maximum day temperature

E. Hydrangeas

1. night temperature of 55-60 degrees F and day temperature of 68-72 degrees F

F. Gloxinias

1. night temperature of 65-70 degrees F and day temperature of 75 degrees F

LEARNING ACTIVITIES

1. Discuss what effects could occur if a flowering pot plant were exposed to extremely high or low temperatures.

2. Discuss commercial methods used to ascertain lower greenhouse temperatures during summer months.

OBJECTIVE 5. Given a particular flowering pot plant, the student will be able to identify the proper forcing techniques with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Forcing Techniques

A. Azaleas

1. proper shape of plant obtained through pinching and growth retardants

    a. two types of pinching

        (1) physical

        (2) chemical

2. forcing

    a. artificial long days for 2 weeks

    b. provide natural short days for 2 months

        (1) night temperature of 60-65 degrees F

    c. place plant in cooler at 35 degrees F for 1 1/2 month with artificial light

    d. place plant in 60-65 degrees F environment

B. Begonias

1. proper shape obtained through physical pinching

2. short day treatment (64 degrees F with 10 hour days)

    a. sufficient new growth development

    b. results in a compact and uniform flowering plant

C. Geraniums

D. African Violets

E. Hydrangeas

1. rest period

    a. 52 degrees F in dark for at least 4-6 weeks

    b. place under 8 hour photoperiods using black cloth from 4 P.M. to 8 A.M.

2. forcing period

a. during June and July use natural greenhouse conditions

b. from August to May use 10 foot-candle incadescent lights from 10 - 2 A.M. at 62 degrees F

F. Gloxinias

1. use growth regulator 1 week after potting mature cuttings

LEARNING ACTIVITIES

1. Explain the difference between dormancy and rest.

2. Explain how temperature and light are associated with both dormancy and rest.

OBJECTIVE 6. Given a particular flowering pot plant, the student will be able to identify the optimum media moisture with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Media Moisture

A. Azaleas, Hydrangeas, Gloxinias*

1. keep media moist at all times

B. Begonias

1. wax begonias should be kept slightly dry between waterings

2. other types should be kept moist

*All three of these plants have a tendency to be affected when water touches their leaves. Necrotic spots will soon appear if the air temperature and water temperature varies eight degrees.

C. Geraniums*

1. keep media moist

D. African Violets*

1. keep media barely moist

*All three of these plants have a tendency to be affected when water touches their leaves. Necrotic spots will soon appear if the air temperature and water temperature varies eight degrees.

LEARNING ACTIVITIES

1. Provide a list of possible methods used in testing for moisture content of medias.

2. Explain why water placed on the leaves of certain plants will result in necrotic spots.

OBJECTIVE 7. Given a particular humidity, the student will be able to identify plants for which this represents the ideal growing humidity with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Humidity

A. Azaleas, Begonias, Geraniums, Hydrangeas

1. average (normal) humidity

B. African Violets and Gloxinias

1. need high-humid conditions

a. humidifying trays can be used to increase humidity

LEARNING ACTIVITIES

1. Discuss methods used to raise and lower the humidity inside of greenhouses.

2. Explain why some plants, especially during propagation, need a high relative humidity in order to grow at a maximum rate.

OBJECTIVE 8. Given a particular flowering pot plant, the student will be able to identify its fertilizer requirements with at least 75% accuracy.

SUBJECT MATTER CONTENT

I. Nutrients

A. Azaleas

1. fertilize every 2 weeks with an acid-type fertilizer

2. a 20-5-5 fertilizer is recommended

B. Begonias

1. fertilize every 2 weeks with a diluted fertilizer

2. responds well to low amounts of nitrogen

C. Geraniums

1. fertilize every 2 weeks with a 20-20-20 fertilizer

D. African Violets

1. fertilize on a regular basis

2. young plants do well with a 20-20-20 fertilizer

3. older plants should have a 12-36-14 fertilizer

E. Hydrangeas

1. fertilize weekly with a 2-1-1 ratio formula

F. Gloxinias

1. fertilize weekly with a 15-16-17 fertilizer

Note: Fertilizer requirements and frequency will obviously decrease when plants stop flowering.

LEARNING ACTIVITIES

1. Discuss what a ratio of 20-20-20 fertilizer means.

2. Explain the difference between a low analysis fertilizer and a high analysis fertilizer.

3. Explain what pH means and how it relates to the reliability of nutrients.

OBJECTIVE 9. Students will be able to list or identify the pests and diseases which are most commonly associated with a particular flowering pot plant. This must be mastered at the rate of 75% or greater.

INSECTS	Azalea	Begonia	Geranium	African Violet	Hydrangea	Gloxinia
aphids	X	X	X		X	
mealybugs	X	X	X			
spider mites	X		X		X	X
thrips	X	X		X		X
leaf miner worm	X					
cyclamen mites		X		X		X
whiteflies		X	X			
foliar nematodes		X				
leaf rollers			X			
loopers						X
army worms						X

DISEASES	Azalea	Begonia	Geranium	African Violet	Hydrangea	Gloxinia
Cylindro-cladium	X					
Botrytis		X	X	X	X	
Powdery mildew		X		X	X	
Stem rot			X		X	
Ring-spot virus					X	

LEARNING ACTIVITIES

1. Provide a list of many of the pests and diseases that could cause damage to the flowering pot plants discussed.

2. Discuss some preventive measures that can be taken when dealing with certain pests.

3. Introduce students to the commonly used terms: insecticides, miticides, and fungicides.

UNIT VII TEST

I. Match the correct response(s) with the appropriate premise.

a.	stem cuttings	_____1.	Azalea
b.	seeds	_____2.	Begonia
c.	leaf cuttings	_____3.	Geranium
d.	leaf-petiole cuttings	_____4.	African Violet
e.	tubers	_____5.	Hydrangea
		_____6.	Gloxinia

a.	African Violets (young plants	_____7.	15-30-15 fert.
b.	Geraniums	_____8.	20-20-20 fert.
c.	Azaleas	_____9.	15-16-17 fert.
d.	Gloxinias	_____10.	20-5-5 fert.
e.	none of the above		

II. True or False Questions

____11. African violets need special forcing requirements in order to thrive and flower.

____12. Stem rot only effects Geraniums.

III. Multiple Choice. Choose the response which best answers the statement or question. Place the answer in the blank provided.

_____13. African violets need a light requirement of _____ foot-candles in order to thrive at an optimal rate.

a. 900 - 1,200

b. 1,500 - 3,000

c. 3,000 - 4,000

d. 5,000

_____14. Azaleas need a light requirement of approximately _____ foot-candles in order to grow at an efficient rate.

a. 900 - 1,200

b. 1,500 - 3,000

c. 3,000 - 4,000

d. 5,000

_____15. Azaleas also require a night temperature of _____ degrees F to grow properly.

a. 30 - 35

b. 40 - 45

c. 50 - 55

d. 60 - 65

_____16. Geraniums cannot withstand a day temperature of more than _____ degrees F.

a. 55

b. 65

c. 75

d. 85

IV. Fill in the blanks provided to the best of your ability.

17. Azaleas require an acid media of _____ - _____ pH.

18. All of the plants discussed, except azaleas, grow well in a media which consists of _____.

19. Hydrangeas flower color can be altered according to the pH of the media. A pH of _____ will result in blue flowers and a _____ pH will result in pink ones.

20. List the three flowering pot plants that thrive in a constant moist media: _____, _____, _____.

21. List the two flowering pot plants that thrive in a highly humid environment: _____ and _____.

22. List two of the insects which are frequently found on the following plants:

    a. Begonia _____ _____

    b. African Violet _____ _____

    c. Gloxinia _____ _____

23. List in a brief outline form the forcing requirements of hydrangeas.

UNIT VII TEST
ANSWER KEY

I. 1. a

2. a, b

3. a

4. d

5. a

6. b, e

7. e

8. c, a

9. d

10. c

II. 11. False

12. False

III. 13. a

14. c

15. b

16. c

IV. 17. 5 - 5.5

18. 1 part peat, 2 parts potting soil, 1 part sand

19. 5, 6.5

20. Azalea, Hydrangea, Gloxinia

21. African Violet, Gloxinia

22. Choose two of the following three:

a. aphids, mealy bugs, thrips, Cyclamen mites, white flies, foliar nematodes

b. thrips, Cyclamen mites

c. spider mites, thrips, Cyclamen mites, loopers, army worms

23. a. Rest period

1. 52 degrees F in dark for 4-6 weeks

2. place under eight hour photoperiods

b. Forcing period

1. June and July -- use natural greenhouse conditions

2. August-May -- 62 degrees F and extend day length hours (10 - 2 A.M.)

UNIT VII
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Class participation
Unit tests

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebook

Teacher

Reference material
Pamphlets

UNIT VII
SUPPLEMENTARY MATERIALS

Ball Red Book Greenhouse Growing, 14th Edition. Geo. J. Ball, Inc. 1985.

Flower and Plant Production in Greenhouses, Kennard S. Nelson. 1978.

Flowering House Plants, James Underwood Crockett. 1972.

Available From: Ohio Agricultural Education Curriculum Materials Service Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

45 slides and script: Diseases of Greenhouse Flower Crops, order number 2070S.

Available From: Ohio Agricultural Education Curriculum Materials Service Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

34 slides and script: Flowering Potted Plants, order number 2042S.

Available From: Ohio Agricultural Education Curriculum Materials Service Room 254, 2120 Fyffe Rd., The Ohio State University, Columbus, Ohio 43210-1099

UNIT VIII
FOLIAGE-TYPE HANGING BASKETS

INTRODUCTION

A popular field in the area of greenhouse management is the selection and culture of hanging baskets. This specialized area of horticulture has attracted the interest of both hobbyist and commercial producers. The versatility and creativity involved in this type of plant culture has contributed much to its appeal.

The purpose of this unit is to provide technical information and basic practical procedures in the selection and culture of foliage hanging baskets.

COMPETENCIES

To select and raise various species of foliage-type hanging basket plants for home use.

GENERAL PERFORMANCE OBJECTIVES/GOALS

Upon completion of this unit, students should be able to:

1. Identify terms related to foliage-type hanging basket production.
2. Determine factors to consider in selecting containers and growing media for foliage-type hanging baskets.
3. Identify environmental factors which influence foliage-type hanging basket plant growth.
4. Identify pest control procedures of foliage-type hanging basket plants.
5. Determine nutritional requirements of foliage-type hanging basket plants.

SPECIFIC PERFORMANCE OBJECTIVES AND MASTERY CRITERIA

1. Given a list of terms related to foliage-type hanging basket production, students will be able to identify or give the meaning of each term with at least 75% accuracy.

2. Given a written exam of factors to consider in selecting containers and growing media for foliage-type hanging basket plants, students will be able to identify or give meaning to factors with at least 75% accuracy.

3. Given a written exam on environmental factors which influence the growth of foliage-type hanging basket plants, students will be able to list or give meaning of factors with at least 75% accuracy.

4. Given a written exam on pest control procedures for foliage-type hanging basket plants, students will be able to list or give meaning of the procedures with at least 75% accuracy.

5. Given a written exam on nutritional requirements of foliage-type hanging basket plants, students will be able to identify or give meaning of requirements with at least 75% accuracy.

METHODOLOGY

A variety of methods can be used to teach this unit. The instructor may implement field trips to a local nursery, resource persons, or an independent study to broaden the students' knowledge of selection and culture of foliage-type hanging basket plants. Lecture and class discussion can also be used to bring out problems and procedures.

SUGGESTED INTEREST APPROACHES

1. Plan several hours of greenhouse work in which selection and culture of various foliage-type hanging basket plants will be implemented.

2. Plan field trip to a local nursery.

3. Discuss with students the potential applications, selection, and culture of foliage-type hanging basket plants for home use.

UNIT OUTLINE

I. Terms

   A. Decor

   B. Foliage

C. Porous

D. Media

E. Soil mix

F. Soil-less mix

G. Loamy soil

H. Peat moss

I. Vermiculite

J. Perlite

K. Leaching

L. Humidity

M. Photosynthesis

N. Pesticide

II. Containers and Growing Media

III. Environmental Factors Affecting Production

IV. Pest and Diseases

V. Nutritional Requirements

SPECIFIC PERFORMANCE OBJECTIVES AND LEARNING ACTIVITIES

OBJECTIVE 1. Given a list of terms related to foliage-type hanging basket production, students will be able to identify or give the meaning of each term with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Terms

A. Decor - furnishings or color schemes.

B. Foliage - leaves of a plant.

C. Porous - able to be permeated or penetrated through usually by water or air.

D. Media - a substance in which plants are rooted or grown -- may or may not contain soil.

E. Soil mix - a media which contains some portion of soil.

F. Soilless mix - a media which contains no actual soil.

G. Loamy soil - a soil containing considerable amounts of all three soil separates (sand, silt and clay).

H. Peat moss - a decomposed substance of plant materials which include large amounts of moss.

I. Vermiculite - a common component of potting mixtures which is noted for water holding capacity.

J. Perlite - a common component of potting mixes used to loosen up mixture and increase aeration.

K. Leaching - loss of valuable plant food elements from root zone usually due to excessive rainfall.

L. Humidity - amount of vapor present in the air.

M. Photosynthesis - the formation of sugars and starches (plant food) from water and CO_2 in the presence of sunlight.

N. Pesticide - chemical substances used to control pests.

LEARNING ACTIVITIES

1. Prepare a list of terms associated with foliage-type hanging basket plant selection and culture.

2. Discuss the relationship of the terms to selection and culture.

3. Obtain necessary materials to either show terms which are material in nature or demonstrate those which are abstract.

OBJECTIVE 2. Given a written exam of factors to consider in selecting containers and growing media for foliage-type hanging basket plants, students will be able to identify or give meaning to factors with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Factors to consider in selecting containers.

   A. Size

      1. Container should be large enough to support roots and foliage.

      2. A 9-inch container is normally considered adequate for a one gallon container plant.

      3. If lined with sphagnum moss, a 12-inch container is used for a one gallon container plant.

   B. Drainage

      1. Containers without drainage holes in their bottoms must have holes drilled or measures taken to prevent overwatering.

      2. Glazed clay, plastic, and acrylic containers do not have drainage holes and do not allow the escape of air and moisture through their sides.

      3. A drip pan or container without holes should be used if the hanging basket is to be located inside a house.

      4. Drainage materials must be placed inside containers without drainage holes.

   C. The container should accent and blend with the colors of the foliage of the plant(s) and the decor of the area in which it will be hung.

2. Potting Media

   A. Must be porous.

   B. Must have ability to hold water.

C. Two types used for hanging baskets.

1. Soil mixes

a. contents should be thoroughly mixed.

b. commonly used mixture is composed of equal parts of loamy soil, sand, and peat moss.

2. Soilless mixes (most commonly used)

a. usually contain bark, vermiculite, and/or perlite.

b. pre-mixes are available from garden centers.

LEARNING ACTIVITIES

1. Prepare a list of soil and soilless ingredients for students to keep for future reference.

2. Obtain different sizes and types of containers to show students.

3. Obtain various ingredients used in soil and soilless mixes and explain advantages of various mixes.

OBJECTIVE 3. Given a written exam on environmental factors which influence the growth of foliage-type hanging basket plants, students will be able to list or give meaning of factors with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Moisture

A. Generally exposed to greater amounts of light, wind, and sun.

B. Faster drying media will require more frequent watering.

C. Plants having holes in the bottom of the container should be watered until the water drains through holes.

2. Humidity

A. Proper humidity is needed to help regulate proper transpiration rates.

B. Hanging baskets placed outdoors have fewer humidity problems.

C. Humidity for indoor baskets can be increased by using a spray (mist) bottle.

D. A large number of plants can tolerate a 25% or higher humidity, and a few plants can tolerate as low as 10%.

1. Sprengeri Fern - 25% or more

2. Spider Plant - 25% or more

3. Marble Queen Ivy - 10% or more

4. My Heart Ivy - 25% or more

5. Swedish Ivy - 10% or more

3. Temperature

A. Temperature has a very important influence on proper plant growth.

B. Some plants are very sensitive to only slightly lower temperatures than their optimum range and others are very sensitive to only slightly higher temperatures than their optimum range.

C. A large majority of plants will have an accepted bottom range limit of about 50 degrees F and the top range limit at about 85 degrees F.

1. Rosary Vine - 60 degrees to 80 degrees F

2. Variegated Rooting Fig - 60 degrees to 80 degrees F

3. Moneywort - 50 degrees to 85 degrees F

4. Strawberry Geranium - 50 degrees to 80 degrees F

4. Light

   A. Light is essential for photosynthesis to occur.

   B. Different species of plants have different light requirements for optimum growth.

      1. Sprengeri Fern - Medium to High

      2. Rosary Vine - High to Very High

      3. Spider Plant - Medium to High

      4. Teddy-Bear Plant - High

   C. Turn hanging baskets periodically to provide uniform light for plants to develop a full, well-shaped plant.

LEARNING ACTIVITIES

1. Prepare a list of common foliage-type hanging basket plants with light, temperature, moisture, and humidity requirements.

2. Visit local nursery to see how to manipulate light, temperature, moisture, and humidity.

3. Manipulate light, temperature, moisture, and humidity factors to observe their effects on plant growth.

OBJECTIVE 4. Given a written exam on pest control procedures for foliage-type hanging basket plants, students will be cble to list or give meaning of the procedures with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Hanging basket plants, like other plants, may become infested with various insects such as:

   A. Rosary Vine - Scale on underside of leaves

   B. Grape-Leaf Ivy - Mealybugs at leaf nodes and axils of leaf to stem

C. Purple-Passion Vine - Aphids on new growth

D. My Heart Ivy - Spider mites on underside of leaves

2. Make sure to select correct pesticides and read directions for correct application.

LEARNING ACTIVITIES

1. Prepare a list of common hanging basket plants and common diseases or insects which infest the species.

2. Locate various disease and insect infested plants to enhance students' ability to identify the problem.

3. Have students read various pesticide labels for them to become more knowledgeable in the proper use of pesticides.

OBJECTIVE 5. Given a written exam on nutritional requirements of foliage-type hanging basket plants, students will be able to identify or give meaning of requirements with at least 75% accuracy.

SUBJECT MATTER CONTENT

1. Various species of hanging basket plants have different nutrient requirements.

2. Leaching of plant food is greater in hanging baskets because of the necessity for frequent watering.

3. Hanging basket plants should be fertilized about twice as often as pot plants.

4. Use half of a normal application of fertilizer to prevent injury from over fertilization.

LEARNING ACTIVITIES

1. Prepare a list of common hanging basket plants with recommended fertilizer applications.

2. Obtain various fertilizers which can be used for hanging basket plants and discuss with the class proper application rates and procedures.

3. Perform a number of experiments in school greenhouse to demonstrate characteristics of over and under fertilization.

APPENDIX A
ENVIRONMENTAL FACTOR REQUIREMENTS

COMMON NAME	LIGHT[1]	TEMPERATURE[2]	HUMIDITY[3]	WATERING[4]
Sprengeri Fern	Medium	Average	Average	Normal
Spider Plant	Medium	Average	Average	Moist
Pothos Ivy	Medium	Warm	Average	Moist
English Ivy	Full	Cool	Average	Moist
Peperomia	Medium	Warm	Average	Dry
Boston Fern	Medium	Average	Average	Moist
Arrowhead Ivy	Medium	Warm	Average	Moist
Swedish Ivy	Medium	Average	Average	Normal
Heart-leaf Ivy	Medium	Warm	Average	Moist

[1] Light
- Low: 50-1000 foot-candles
- Medium: 1000-3000 foot-candles
- Full: 4000-9000 foot-candles

[2] Temperature
- Cool: 40° to 50° F (or greater)
- Average: 50° to 60° F (or greater)
- Warm: 60° to 70° F (or greater)

[3] Humidity
- Dry: 10% to 20%
- Average: 20% to 60%
- High: 60% or greater

[4] Water
- Dry: Allow to dry between waterings
- Normal: Allow to dry slightly between waterings
- Moist: Evenly moist

APPENDIX B
BEDDING PLANT PRODUCTION

GERMINATING TEMPERATURE	PLANTING DATE	BLOOMING	GERMINATING TEMPERATURE	DAYS TO GERMINATE	GROWING TEMPERATURE*
Ageratum	Mar.-June	June-frost	70-80°	8	60°
Alyssum	Jan.-Dec.	Jan.-Dec.	70°	8	50°
Balsam	Mar.-Sept.	May-Nov.	70°	8	60-65°
Begonia	Dec.-Feb.	May-frost	70-75°	14-21	60°
Calendula	Sept.-Nov.	Mar.-May	70°	10	60-65°
Celosia	Mar.-Sept.	June-Nov.	70°	8-10	65°
Coleus	Jan.-Mar.	Foliage	65-75°	10	60°
Dahlia	Jan.-Feb.	June-frost	65-75°	10	55°
Dianthus	Sept.-Feb.	Nov.-June	70°	7	55°
Geranium	Dec.-Jan.	April-May	70-75°	5-10	60-65°
Impatiens	Jan.-Feb.	June-frost	70°	10-15	60°
Lobelia	Nov.-Feb.	Apr.-July	70-75°	20	50-55°
Marigold	Mar.-July	June-frost	70-75°	5-7	60°
Pansy	Aug.-Nov.	Nov.-May	65°	10-18	50°
Periwinkle	Mar.-Aug.	June-frost	70-75°	15-20	60°
Petunia	Jan.-Mar.	Apr.-Aug.	70°	5-10	50-55°
Phlox	Sept.-Mar.	Jan.-June	65°	10	50-55°
Portulaca	Mar.-July	May-Oct.	70°	10-15	60°
Salvia	Sept.-Mar.	Apr.-frost	70°	15-20	60-65°
Snapdragon	Sept.-Feb.	Mar.-June	70°	8-12	50°
Verbena	Nov.-Mar.	Jan.-Dec.	65°	14-21	55°
Zinnia	Feb.-Aug.	May-Nov.	70°	6-10	60-65°

*Cool-growing temperatures produce compact, high-quality bedding plants.

UNIT VIII TEST

1. Define the following terms:

   a. Decor:

   b. Foliage:

   c. Porous:

   d. Media:

   e. Soil mix:

   f. Soilless mix:

   g. Loamy soil:

   h. Peat moss:

   i. Vermiculite:

   j. Perlite:

   k. Leaching:

   l. Humidity:

m. Photosynthesis:

n. Pesticide:

2. How large should the container be?

3. Why should containers have drain holes in them?

4. What special precautions should be taken when placing the hanging basket indoors?

5. List two factors to consider when selecting a container (besides size and drainage).

   a.

   b.

6. List two characteristics which a potting media should have.

   a.

   b.

7. Why do hanging basket plants require frequent watering?

8. All hanging basket plants perform well at 10% humidity. True or False _____

9. All hanging basket plants perform best at about 35° F. True or False _____

10. Light is important for which major plant process to occur?

11. Explain why hanging basket plants should be turned periodically.

12. What are two groups of pests?

13. One should take care to select the correct _____ when looking to eliminate the pest problem.

14. Explain why leaching occurs in hanging basket plant production.

15. Why should hanging basket plants be fertilized more frequently as pot plants?

UNIT VIII TEST
ANSWER KEY

1. a. furnishings or color schemes

   b. leaves of a plant

   c. able to be permeated or penetrated through usually by water or air

   d. a substance in which plants are rooted or grown - may or may not contain soil

   e. a media which contains some portion of soil

   f. a media which contains no actual soil

   g. a soil containing considerable amounts of all three soil separates (sand, silt and clay)

   h. a decomposed substance of plant materials which include large amounts of moss

   i. a common component of potting mixtures which is noted for water-holding capacity

   j. a common component of potting mixes used to loosen up mixture and increase aeration

   k. loss of valuable plant food elements from root zone usually due to excessive rainfall

   l. amount of vapor present in the air

   m. the formation of sugars and starches (plant food) from water and CO_2 in the presence of sunlight

   n. chemical substances used to control pests

2. Large enough to support roots and foliage of plants and to allow space for plant growth.

3. To allow proper drainage of soil media and prevent overwatering.

4. A drip pan or a container that does not have holes should be used.

5. a. Blending of container with color(s) of plant.

   b. Decor of area where it will be hung.

6. a. Must be porous.

   b. Must have ability to hold water.

7. They are generally exposed to greater amounts of light, wind and sun.

8. False

9. False

10. Photosynthesis

11. To provide uniform light for plants to help maintain uniformity of plant growth.

12. a. Diseases

    b. Insects

13. Pesticide

14. Because of frequent watering.

15. Because of leaching of plant food elements.

UNIT VIII
EVALUATION AND TESTING

Ways to Evaluate Pupil Growth

Pupil growth
Students' demonstrating skills at school greenhouse or at individual's home
Unit test

EQUIPMENT AND SUPPLIES

Student

Reference material
Notebook
Supplies to prepare a hanging basket

Teacher

Reference material
Pamphlets
Overhead projector
Transparencies
Hanging basket supplies

UNIT VIII
SUPPLEMENTARY MATERIALS

Greenhouse, Golden Press.

Plant Science/An Introduction to World Crops, Janick, Schery, Woods and Ruttan, 1974.

Producing Plants for and Preparing Hanging Baskets, Vocational Instructional Services, Texas A & M University.